SCIENTIFIC AMERICAN

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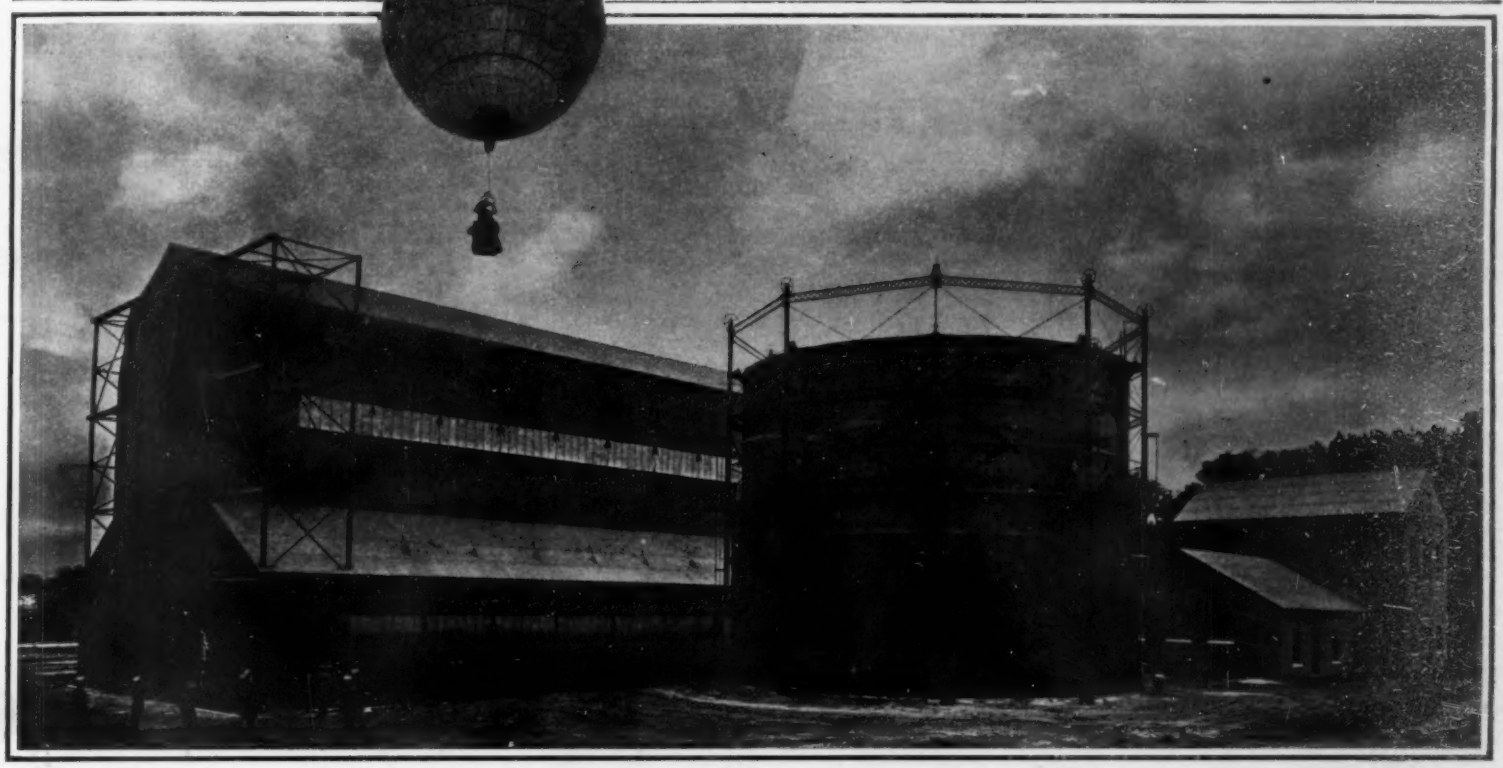
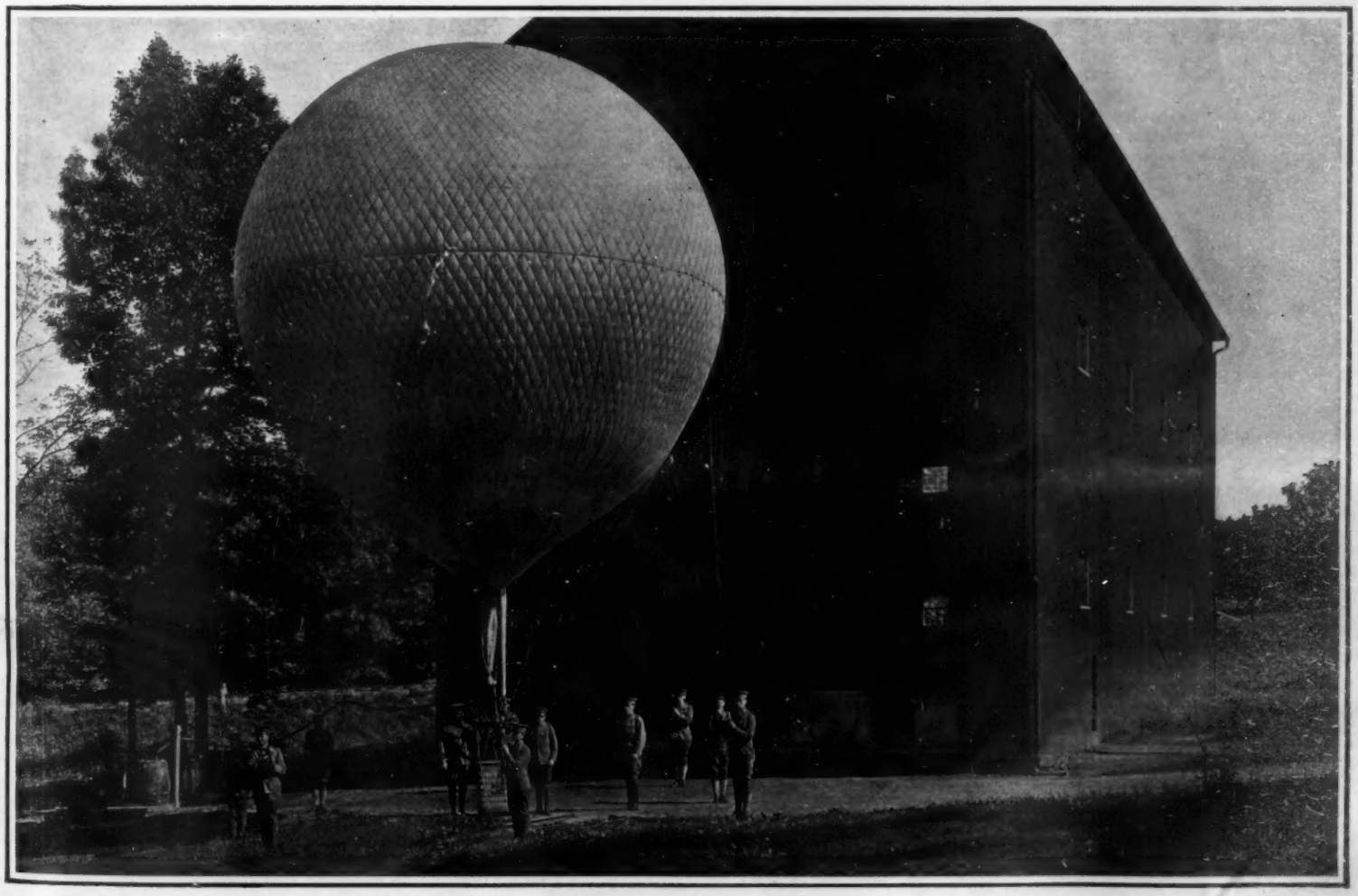


The balloon house, gas holder, and gas house at Fort Omaha, Neb.



The balloon house at Fort Myer, Va., with signal corps detachment and hydrogen balloon No. 9.

OUR AERONAUTICAL ORGANIZATION.—[See page 350.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, NOVEMBER 13th, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LOCAL MAGNETIC DISTURBANCES AND THE GENESIS OF PETROLEUM.

In a bulletin recently published by the Geological Survey, Mr. George F. Beiker ingeniously inquires whether there is not a hitherto unsuspected relation between magnetic disturbances as manifested by the compass needle and petroleum deposits. Any such attempt must necessarily be based on some definite theory of petroleum's origin. Accordingly Mr. Beiker summarizes the condition of knowledge with reference to the origin of petroleum and other bituminous substances. The result is thoroughly unsatisfactory. Some oils are undoubtedly organic and some are beyond question inorganic. The evidence shows that neither variety can properly be regarded as unimportant. Mr. Beiker's review, however, does not elucidate the source of the principal deposits, the great petroleum pools. They may have been derived from carbonaceous matter of vegetable or animal origin, and they may have been derived from carbides of iron or other metals. It is also barely possible that the hydrocarbons exist as such in the mass of the earth.

In thinking over this situation it occurred to him to inquire whether any relation could be detected between the behavior of the compass needle and the distribution of hydrocarbons. Not very much could be expected from a comparison of these phenomena, for magnetite exerts an attraction on the needle whether this ore occurs in solid masses or is disseminated in massive rocks; and again, many if not all volcanic rocks possess polarity, so that repulsions are involved as well as attractions. Even if the iron carbide theory of genesis were known to be correct, and exclusively correct, no one would think of maintaining that all bodies of magnetite have a connection, however remote, with the occurrence of petroleum. Hence any indications of iron carbides and associated petroleum which the compass might be supposed to afford would be obscured by the local attraction of independent masses of magnetite. Earth currents are also to some extent local and thus produce irregularities in declination.

Nevertheless, irregularities of the curves of equal declination on Bauer's map of the magnetic declination in the United States, are strongly marked in the principal oil regions. When this map is compared with one prepared by Mr. David T. Day showing in detail the known hydrocarbon deposits of the United States the coincidences recognized become more striking and other agreements become evident.

The most marked agreement is found throughout the great Appalachian oil field, which is the area of greatest variation in declination. In California, also, strong deflections of the isogonal lines accompany the chain of hydrocarbon deposits. In the interior of the country the coincidences are less marked, but they are very noticeable.

There are other systematic irregularities, wrinkles in the isogonic topography, which can not be connected with oil. One such wrinkle runs down the Atlantic coast and contains the New Jersey native iron as well as known deposits of magnetite. Another lies near latitude 47 deg. and is doubtless due to the great northern iron belt.

No detailed chart of the magnetic declination in the petroleum fields of the Caucasus has yet been prepared. Mr. Bauer states that great magnetic disturbances exist in that region, so that relations not dissimilar to those in this country are probable.

On the whole, coincidences between the occurrence of petroleum and local disturbances of the compass needle are too numerous to be attributable to mere accident or chance. There must therefore be a direct or an indirect historical connection between the two phenomena in the regions of coincidence.

No one doubts the vast industrial importance as well as the deep geological interest of the petroleum question. As time elapses it will grow more and more important, for the pinch of dwindling coal resources will probably affect children of those already born. In the interest both of the development and the conservation of our natural resources all the means at the command of science should be brought to bear on this mysterious subject. A geologist and a chemist each of the highest order should be coupled in the long and difficult investigations needed to elucidate the genesis of petroleum. The initial expense would be considerable, but the ultimate economy would be enormous.

THE FIFTH VANDERBILT CUP RACE AND THE GOOD ROADS TOUR FROM NEW YORK TO ATLANTA.

It is seldom that the public has an opportunity to witness notable speed and reliability contests contemporaneously, but such was the case this year when the Vanderbilt cup race was run on Long Island on October 30th, while the reliability tour promoted by the New York Herald and the Atlanta Journal was also being conducted.

Although the race has lost much of its former glamor through the substitution of high-powered stock chassis for the huge racers that used to compete, it nevertheless gives a good idea of the speed and endurance qualities of the machines that are being regularly produced for the market.

The fifth annual race was run over a 12.64-mile course, which included the cement motor parkway, upon Long Island, and consisted of 22 laps (278.08 miles). There were 15 competitors, while the four stock cars that took part in the Wheatley Hills Trophy race and the six in the race for the Massapequa Trophy, both of which were run simultaneously, made a total of 25 machines that were traveling around the course at the start. The two secondary races were 189.6 and 126.1 miles in length respectively, and were for cars of smaller horse-power and lighter build.

The Vanderbilt race was won by the 60-horse-power 6-cylinder Alco car driven by H. F. Grant. The time was 4 hours, 25 minutes, and 42 seconds. The average speed maintained was 62.77 miles an hour, as against 64.38 made by Robertson last year on a better course with a 120-horse-power Locomobile. During the last four rounds an average of over 70 miles an hour was maintained, the last one being covered in 10:33 at the rate of 71.9 miles an hour. This machine—an improved American model of a well-known French car—has always done well in all contests in which it has been entered, and it was not at all surprising that it should win America's premier racing event.

The only other car to finish was Parker's Fiat, which averaged 61.55 miles an hour. Only two other cars—an old Mercedes and the two-cycle Atlas—were running at the end. This is said to have been due to the use of the motor parkway as more than half the course, which was only half the length of those used in previous years. The cement surface of this road has slight undulations that make it a very severe test of both tires and mechanism. Two cars broke their steering knuckles, four had cracked cylinders, and three sustained a broken crankshaft, a broken rear axle, and a damaged radiator, respectively.

The 189.6-mile race was a walkover for Harroun on a Marmon, as the three other cars in the race lost many minutes making repairs, and one of them withdrew when the race was half done. The average speed of the winner was 59.76 miles an hour.

The 126.4-mile race was won by a Chalmers-Detroit 30-horse-power car in 2 hours, 9 minutes, 52 2/5 seconds at an average speed of 58.4 miles an hour. Two Maxwell machines were second and third with an average of 51.1 and 50.4, respectively, while a 22-horse-power Hudson secured fourth place with a 50-mile-per-hour average.

The reliability tour which was promoted for the purpose of spreading the good roads doctrine by giving the farmers of the South an ocular demonstration of the value and usefulness of the automobile, especially where good roads obtain, was carried out with marked success. Forty-seven cars left New York on the morning of October 25th and covered the 1,100 miles of varying kinds of roadway passing through nine States and leading to Atlanta in ten days without serious trouble. Twenty-six of these machines made the journey on schedule time with a perfect score. They were divided into six classes, ranging in price from $4,000 down to $850. The Maxwell runabout was the sole prize-winning representative of the lowest priced class. This reliability run had been well planned by the newspapers which conducted it. Many roads on the route were improved especially for the tourists, and in all probability there will eventually be established a national highway from New York to Florida as a result of the impetus given the movement for such a road by the tour which has just been completed.

NON-TOXIC COFFEE AND TEA.

It is a somewhat singular fact that each of the staple household beverages, coffee, tea, and cocoa, contains an alkaloid, a poison. In small doses these alkaloids have a certain stimulating effect upon the system, and it is presumably on this account that the beverages which contain them have acquired such popularity. At the same time there seems to be no room for doubt that these beverages act as aids to the digestion. Still, the fact remains that the alkaloids of coffee, tea, and cocoa are toxic substances. Their ingestion in excess may become harmful even to strong and healthy persons. For this reason endeavors have been made to find suitable substitutes, which should possess the advantages and pleasing properties of our common household beverages, but free from the poisonous constituents which these latter contain.

We must look to special processes of treatment of ordinary coffee for our supply of a non-toxic product free from alkaloids. One such process, the product of which is upon the market, consists first in a preliminary treatment of the coffee beans, whereby their cell tissue is loosened. They are next subjected to the action of acid or alkali, and the caffein can then be extracted with a volatile solvent, such as benzene, ether, chloroform, petroleum ether, etc. The residue of solvent left in the material after the extraction is expelled by treatment with high-pressure steam or *in vacuo*.

A new process, invented by Prof. Kippenberger, who has abandoned his patent claims and made the method public property, consists in treating the coffee with oil, and subsequently with acetone or glycerine.

The inventor has found that caffein is insoluble in oil at ordinary room temperature, but is readily soluble in hot oil. Furthermore, caffein tannate, which is present in coffee side by side with free caffein, while practically insoluble in ether, benzene, and chloroform, is readily soluble in glycerine and acetone.

The new process accordingly consists in treating the coffee with fatty oils (glycerides) at temperatures and pressures at which the glycerides are not decomposed. After this step the coffee is freed from adhering liquid in any suitable manner, e. g., by centrifugal action. The oil may be freed from caffein either by simply allowing it to cool, when the alkaloid is precipitated, or by extracting with a suitable solvent. After this treatment the coffee still contains a small proportion of caffein, namely, that which is present "bound" in the form of tannate. This can be eliminated by treatment with glycerine or acetone or both. If preferred this step can be carried out before the treatment with hot oil. The temperature in this latter should not exceed 200 deg. C., for decomposition of the glycerides must at all events be avoided.

In place of the glycerides (oils) it has been found that quite a large number of other substances can be used. One condition which they must satisfy is that they should be liquid at say 100 to 150 deg. C. Among substances may be mentioned the aliphatic hydrocarbons, and those of the aromatic series; also derivatives of the latter, especially their alkyl and chlorine substitution products; further, the higher alcohols, ethers, and esters, such as amyl alcohol, amyl ether, and ethyl acetate. But none of these substances is quite as well adapted as the glycerides for the extraction of the caffein, as they leave a residue behind the complete elimination of which is attended with some difficulty.

The treatment with oil does not only extract the caffein, but also certain resinous substances. As the result of this the taste of the coffee is improved. In the case of tea the conditions are less fortunate. Here the process causes the loss of certain of the constituents which impart its characteristic aroma to the tea. The results of the extraction of coffee with glycerine and acetone also are not entirely satisfactory. To an expert taster the product appears not quite faultless. To the ordinary consumer, however, it is quite indistinguishable from the natural untreated ware.

The principal object of a recently designed clock is to show at a glance, says the Journal of the Royal Society of Arts, the time all over the world. In front of it a disk is mounted, which revolves with the earth once in 24 hours, having the hours 1 P. M. till 12 midnight, and 1 A. M. till 12 noon, painted on its outside edge, the hours being divided into intervals of five minutes each. In the same plane as the disk is a fixed dial, with a circular aperture to accommodate the disk. The dial has Greenwich painted on the top, the names of the other places being arranged at such distances from Greenwich that at any moment the corresponding time for any part of the world is shown. The clock it set by turning the disk, so that the time at any place abroad at a given time in London, or other place, can be easily read off.

ENGINEERING.

New traffic records were made by the Subway and elevated railways in New York during the Hudson-Fulton Celebration, 2,200,000 passengers being carried on the day of the military parade.

A variable stroke petroleum engine has been designed by Messrs. J. F. Gill and T. C. Aveling, intended to overcome the difficulties which prevent such engines being applied directly to the shaft of a vehicle, as in the case of the steam engine.

The total excavation now made in the Panama Canal to the end of September last is 87,172,058 cubic yards, which is only about three hundred yards short of one-half the total excavation required. As the average daily excavation is over 100,000 cubic yards, it may safely be said that half the work was done by the end of the first week in October.

The hurricane in New Orleans on September 20th caused an interruption in the operation of the pumps of the drainage system, owing to their being electrically operated and the overhead transmission line being blown down. Temporary wires were strung up hastily on telegraph poles, and pumping resumed in 48 hours, but it is now proposed to build a duplicate transmission line, and eventually to put the whole of it underground.

In connection with the landing of the Cunard steamers at Fishguard in Wales, the Great Western Railway of England has put on a new special train to London, which has been making remarkable time. On a recent run a train with a total weight of 300 tons was drawn by the new engine "King Edward" from Fishguard to London, 261 miles, at an average speed, including one stop of four minutes, of 61.2 miles per hour.

An improvement much needed elsewhere also is being tried by the Chicago Railways Company for the forced ventilation of street cars. A double ceiling is used with a number of openings like those of a hot-air heating system, the space between upper and lower ceiling acting as an exhaust duct. Fresh-air intakes are cut through the floor near the sides of the car, the screened air admitted passing through electric heaters under the seats before entering the interior of the car.

A remarkable piece of work was done by Messrs. David Rolls & Son of Liverpool in the fitting of a new high-pressure cylinder of improved design to the steamer "Star" of New Zealand. The vessel being engaged in the meat trade, it was desired if possible that the change should be made in the time required to discharge her cargo at Liverpool; and although it involved the machining and fitting of all auxiliary parts, it was completed in five and one-half working days.

One of the unusual features of the work on the Ashokan reservoir in the Catskills is the use of special steam rollers for "puddling" the earth fills on either side of the concrete core-walls of the dikes. Over six million cubic yards of earth must be spread in six-inch layers, moistened and rolled, eventually forming a dam 300 feet high in places and four miles long, so the work of the rollers is considerable. They have corrugated front rolls and cross-cleats on the rear rolls, so as to thoroughly knead the moist earth, and each covers the work done by thirty men, a dozen teams, and a cableway, and is guaranteed against breakdown in continuous work for seven years.

In the House of Commons recently the question was raised as to whether the Home Office would consider the question of compelling tramway authorities to fix on their cars a device for making a continuous noise when the speed exceeds a certain limit, as is now done in the case of motor omnibuses. Mr. Masterman replied that the question was under consideration, but the application of the device to tramcars presented special difficulties, owing to the varying limits of speeds authorized for tramways. Mr. Myer asked if Mr. Masterman was aware that some of the cars on the Thames Embankment traveled at a speed of over 20 miles per hour, but no answer was given.

There has been much favorable comment in the engineering press upon the completion, in six months less than the contract time and well within the estimated cost, of the widening of Blackfriars Bridge in London. This bridge, which is 140 years old, consists in its present form of five iron arches ranging in span from 155 to 286 feet between masonry piers founded on wrought-iron caissons filled with concrete, the original masonry arches having been removed and the bridge enlarged in 1864. The work completed last month by Sir William Arrol & Co. as contractors was necessitated by the plan of the London County Council to carry its tramways across the bridge, to connect its northern and southern systems. The roadway was widened by 30 feet, which involved the moving bodily for that distance of wrought-iron face ribs, 155, 174, and 186 feet long respectively, out to the end of the extended piers.

ELECTRICITY.

It is reported that a series of wireless telegraph stations are to be installed in Siberia which will enable the War Department of Russia to keep in communication with the easternmost parts of the empire. These stations are to be large enough to operate over a radius of a thousand miles.

It has been suggested from time to time that the air in the subway could be rendered less obnoxious by supplying each car with apparatus for producing ozone, but the mere conversion of oxygen already in the subway into the form of ozone would not solve the difficulty. What is needed is a fresh supply of oxygen to take the place of that consumed by the passengers and converted into carbon dioxide. A recent editorial in the Electro-chemical and Metallurgical Industry calls attention to the system of Dr. R. Von Foregger, who a few years ago proposed the use of fused sodium peroxide. Water added to this chemical would cause the production of sodium hydroxide and would liberate oxygen. The sodium hydroxide would then absorb the carbon dioxide of the air and thus in addition to furnishing a fresh supply of oxygen it would purify the air as well.

Strange as it may seem to the uninitiated, the cost of operating an electric car depends to a large extent on the motorman. The economical motorman will permit his car to coast whenever possible and in this way will effect a considerable saving of power. Each application of the brakes means a waste of power. Recently an apparatus has been devised for keeping a record of the periods of coasting of different cars. The device is connected both with the electrical controller and with the air brakes and operates only when both the controlling apparatus and the brakes are in the "off" position. The record is made on a paper ribbon driven by a clock. This record makes it possible to judge of the relative economy of different motormen operating on the same line and encourages them to let the cars coast whenever it is possible to do so without falling behind their schedule.

One of the main advantages of electrifying a railroad system lies in the fact that instead of having a large number of portable power plants represented by the locomotives, all the different power units are brought together in one central station and thus considerable economy is possible, if for no other reason because a separate reserve power is not required for each train. The same argument applies to the centralizing of central power stations. Instead of having different concerns manufacture their own electricity the power could all be generated in one large station. Recently the New York Edison Company has offered to furnish power for the Broadway-Lexington Avenue subway. The Edison Company points to the fact that it is well equipped to furnish the power required and has an adequate reserve to meet all demands.

Replying to the popular demand that the Illinois Central Railroad should electrify its terminal in Chicago, President Harahan points out the fact that electric traction is still in the experimental stage and that little as yet is known of the use of electricity for handling freight. The Illinois Central is obliged to interchange trains and cars with other roads and considerable inconvenience would be occasioned by the use of electric traction in its freight yards. He also suggests that the smoke nuisance could be eliminated by other means, and until a comprehensive plan has been developed for electrifying all the railroads that enter Chicago it would be impracticable for the Illinois Central to make a change in the power it uses. The railroad is making experiments with cars operated by gasoline engines and is testing the use of coke instead of soft coal. As a matter of fact, the railroads of Chicago contribute only a small portion of the smoke that clouds the city. However, the City Council is considering an ordinance which will compel every railroad in Chicago to use electricity.

The extensive use of trackless trolley cars in continental Europe has led British manufacturers to make experiments with a view to producing a type particularly adapted to the requirements of their own traction systems. Recently a car has been developed which possesses many very interesting features. Chief of these is the trolley head and its connection to the car. A three-wire system is used, the current being collected from two outer wires while a central wire takes the place of a ground. The head is supported in a horizontal position by means of a sort of parallel-ruler connection, there being two poles connecting it with the roof of the car. The head can be converted into a single-pole trolley head whenever it is desired to run the car on a track system, and in this case the ground is taken care of by a pair of shoes which ride on the rails. The overhead wires are so arranged that they can be adapted for a track system at a minimum expense whenever the traffic makes such a change advisable. It is merely necessary to remove the outer wires and leave only the central trolley wire.

SCIENCE.

Jean Comandon announced before the Academy of Sciences on October 27th the development of a new method of photographing bacilli by the combined use of an ultra-microscope and a cinematograph.

After examining the documents presented for consideration by Lieutenant-Commander Peary, the National Geographical Society has reached the decision that he reached the North Pole, and has decided to award him a gold medal for his exploit.

A cablegram has been received at Harvard Observatory from Kiel stating that Winnecke's comet was observed by Pons of Laplate, Oct. 31 d. 5040 Gr. M. T. in R. A. 17 h. 11 min. 51.6 sec. Dec. —27 deg. 18 min. 43 sec. The comet is visible in a small telescope.

Prof. Metchnikoff, as our readers well know, advocates the drinking of much fermented milk to check the intestinal putrefaction of food, and thus prolong life. In furtherance of his end, bonbons have been prepared, consisting of a lactic-acid product surrounded by a sweetened chocolate coating. The sugar of the coating assists in lactic-acid fermentation.

An alloy which may have a considerable value for steel processes is now manufactured in the electric furnace in France. This is the mangano-silicide of aluminium, formed of manganese, silicon, and aluminium, containing generally from 1 to 2 per cent of iron and 0.25 per cent or less of carbon. Sulphur and phosphorus are practically absent. The new alloy has been found to answer very well as a de-oxidizing agent in steel making. During the refining it is transformed to silicate of manganese and aluminium, giving a very fusible slag which is easily separated from the melted metal. It is claimed that the steels which are obtained by the process are very homogeneous and are free from porosity. The proportion of the new alloy is about as follows: Manganese, 75 per cent; silicon, 37 per cent; and aluminium, 18 per cent. In the steel process, 100 parts of alloy combine with 71 parts of oxygen to give 171 parts of slag.

The $1,000,000 given by John D. Rockefeller will go a long way toward eradicating the "hookworm." The worm was identified in 1903 by Dr. Charles Wardell Stiles of the Rockefeller commission. Soil pollution is responsible for the existence and spread of the worm. It can be eliminated from the human body by a simple treatment of thymol and Epsom salts, the patient in most cases being cured in several days. Pronounced anæmia is the chief symptom of persons afflicted with the hookworm disease, accompanied by emaciation and great physical weakness. Laziness, mental lassitude, and stupidity are other symptoms. Uncinariasis is the technical name for the disease. Hookworm disease was probably known to the Egyptians near 3,000 years ago, but its cause was not understood until about the middle of the nineteenth century. The hookworm is about half an inch long. It lives in the small intestine.

Once it was possible to buy radium at $2 a milligramme; now the market price is $90 a milligramme, equal to $2,500,000 an ounce. This was one of the striking statements in a very interesting speech delivered by Sir William Ramsay at the foundation stone laying ceremony of a new radium factory in Limehouse, an eastern suburb of London. The British Radium Corporation, which is going to extract radium from pitchblende found in the Trenwith mine, Cornwall, is believed to be the first company in the world to attempt the production of the precious mineral on a commercial basis. It is one of the romances of science that the material in the old days was regarded by the Cornish miners as a nuisance, for it prevented them from obtaining copper from smelting. For a long time it was cast on the dumps or left underground. To-day the comparative value of crude pitchblende ore is far in excess of the gold quartz of Johannesburg or the blue earth of the diamond mines.

The swamp potato (*Solanum Comersonii*), which grows wild in Uruguay, has lately been cultivated in France, where it has produced a variety with violet tubers. The new variety is characterized by extraordinary productiveness, resistance to disease and frost, and the production of large aerial tubers in the axils of the leaf stalks. German potato growers, however, find the new variety so similar to the long-known variety "Paulsen's Blue Giant" that they are inclined to think that the latter has, innocently or designedly, been exploited in France as a novelty. The same opinion is held by a prominent English potato grower. The two sorts have also been cultivated, side by side, at the experiment station of a Swedish society for the improvement of moors, where they appeared to be identical in foliage, flowers, and tubers. The swamp potato, however, proved less productive than the old Blue Giant, and its most strongly emphasized peculiarities, antipathy to lime and preference for marshy soil, could not be detected. Similar results were obtained on an experimental plantation in Silesia.

ARCHAEOLOGICAL RELICS FROM THE SEA.

BY FERDINAND WORTHINGTON.

In 1907 a Greek sponge-fishing craft discovered, three miles off the coast of Madhia between Sousse and Sfax, at a depth of about 150 feet, the wreck of a vessel some 100 feet long and 20 feet beam. The cargo of the sunken vessel consisted of sixty columns of white marble arranged in six rows, the columns being topped with Corinthian or Ionic capitals, and otherwise painstakingly and artistically carved. Furthermore, there were several statues.

M. A. Merlin, Director of Antiquities, of Tunis, has advanced the theory that the vessel was an ancient galley which had left Greece, bound probably for Italy. Contrary winds had driven it on the coast of Tunis, where it foundered at a time which may be approximately placed at about the beginning of the Christian era.

The relics which have been brought to the surface from this ancient wrecked ship are undoubtedly of Greek origin. Several bronze statues have been recovered. One of them, a figure of Eros, is thought to be a replica of the Eros of Praxiteles. There is also a Hermes of Dionysus, fragments of candelabra and of beds, also a statuette about 14 inches high, which might have served as a lamp, for the head is hollowed out to form an oil well.

The marble relics are more numerous than those of bronze. They comprise capitals of various decorative designs; drinking cups embellished with Bacchic basreliefs which remind one of the celebrated Borghese vase of the Louvre; statuettes, busts, and the like. One column which was brought ashore measures 13½ feet in height, and nearly 2 feet in diameter at the base.

It may be stated that this artistic treasure trove of the sea was recovered at the expense of the Tunisian and French governments, the Académie des Inscriptions et Belles-Lettres, and several wealthy gentlemen. The French navy assisted in bringing the material to the surface. The divers employed were Greeks who had forsaken their calling of sponge fishing to devote themselves to the more artistic vocation of fishing for statues. All the objects which have been recovered will eventually find a place in the Bardo Museum at Tunis.

A Pure Air Law for Workmen.

BY C. M. RIPLEY.

It costs money to purify anything. Whether it be the Panama Zone that must be made habitable, or a political situation which requires a housecleaning, all of these worthy enterprises require considerable expenditure and there will always be found some who protest. Even our worthy pure food law came in for its share of complaint, and now we learn that the New York labor law requiring a supply of fresh air for the employees of workshops and factories is being subjected to some criticism.

The law reads as follows:

"The owner, agent or lessee of a factory shall provide, in each work room thereof, proper and sufficient means of ventilation, and shall maintain proper and sufficient ventilation; if excessive heat be created or if steam, gases, vapors, dust or other impurities that may be injurious to health be generated in the course of the manufacturing process carried on therein, the rooms must be ventilated in such a manner as to render them harmless, so far as is practicable."

Mr. William W. Walling, chief factory inspector for the State of New York, interprets the law as follows:

"As defined by Dr. John S. Billings, perfect ventilation means that any and every person in a room takes into his lungs at each respiration air of the same composition as that surrounding the building, no part of which has recently been in his own lungs or those of his neighbors, or which consists of the products of combustion generated in the building, while at the same time he feels no currents or drafts of air, and is perfectly comfortable as regards temperature, being neither too hot nor too cold. How much air is required to meet these conditions? Not less than 2,000 cubic feet per hour for each person, with the same amount per hour for each cubic foot of gas consumed whether for light, heat, or power."

Some landlords in New York city have put forth the claim that the amount of fresh air specified by the Department of Labor was an "arbitrary quantity." Several authorities on the subject of ventilation who have been consulted in the matter and who are also entirely disinterested agree that 2,000 cubic feet per hour per person is common practice and is based upon definite laws or rules which have been followed for many years in the design of ventilating systems.

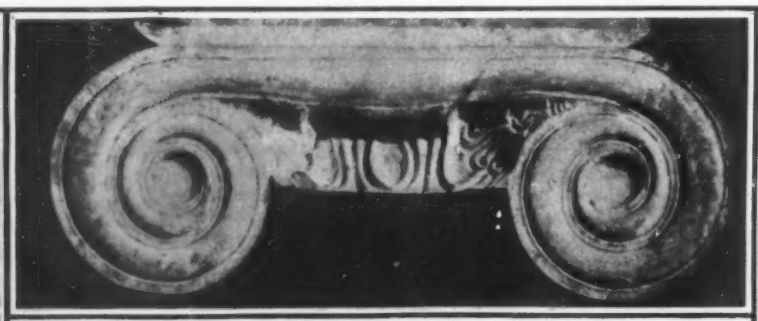
The "Architects' and Builders' Pocketbook," written by Mr. Frank E. Kidder, C.E., Ph.D., states (and this book is an authority and therefore a record of current practice) that 1,800 cubic feet per hour per child should be the standard for school buildings, this amount being required by law both in Massachusetts and New York. It further states that in buildings more closely packed, and occupied for a longer period, the air supply should be from 2,000 to 2,500 cubic feet per hour per person. In giving an example of a school room of certain dimensions, he shows that the standard amount of air would result in the air in the room being changed about eight times per hour—which certainly does not appear to be an excessive amount.

Since the above applies only to buildings where people sit quietly, or for buildings where only children congregate, it is difficult to see how the representatives of the New York Department of Labor can justly be accused of any "arbitrary" action in interpreting the meaning of "proper and sufficient" ventilation.

Mr. Percival Robert Moses, consulting, heating and ventilating engineer of New York city, states that he has found the rate of 2,000 cubic feet per hour per person a satisfactory and conservative working basis.

In a loft 25 feet wide and 100 feet long, containing

A bronze Hermes.

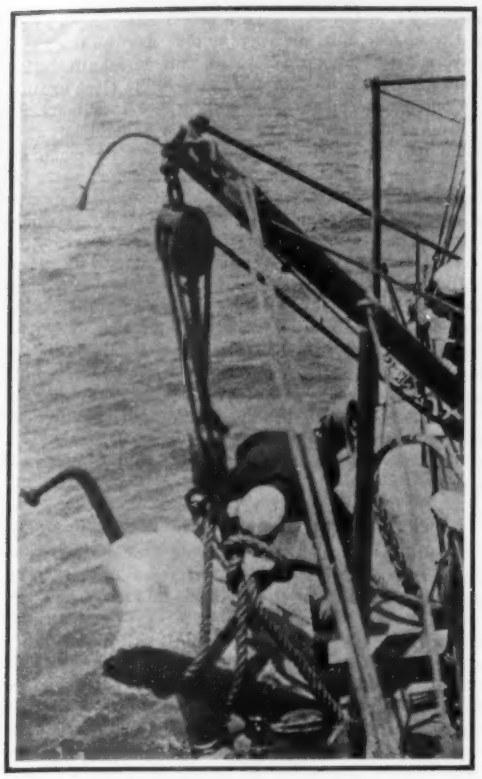


A marble Ionic capital.

Marble bas-relief depicting a funeral banquet.

A bronze statue of Eros.

ARCHÆOLOGICAL RELICS FROM THE SEA.



Fishing for archæological relics.

80 workmen, and lighted with electricity, the amount of air required would be $80 \times 2{,}000 = 160{,}000$ cubic feet per hour. This amount of air per hour would move at the rate of about ¼ of a mile per hour, and would be sufficient to change the air in the loft six times per hour, assuming a 10-foot ceiling. Since the Massachusetts and New York State laws for school rooms require eight changes per hour, and since some authorities recommend even 50 per cent in excess of this, it appears that the action of the factory inspector hardly comes within the definition of the word "arbitrary" which in the Standard Dictionary means "done capriciously" or "without adequate determining principle," or "non-rational," not done according to reason or judgment; depending on the will alone; tyrannical; despotic; not fixed by rule.

The operating cost for a ventilating system is made up of two items: (1) Power for turning fans; (2) additional heat for incoming air. In a loft building where the tenant will pay for the power, the expense will automatically be divided and the landlord will pay for the extra heat required, since heat is included in the rent. It will also be noticed that again the adoption of electric lighting will cut the bills for operating expense to a remarkable degree. This cut in expense will affect the tenant, since a much smaller ventilating motor will be required, and it will also affect the landlord because less air will have to be drawn in, and hence the cost for heating would be diminished.

In large systems the services of an expert heating and ventilating engineer would probably prove valuable, and it is possible so to design the equipment that a judicious "recirculation" of the air from halls and basements will effect an economy in the fuel bill. This air is seldom impure and requires much less heat than if cold air were brought in from outside. It is also possible in buildings where high-pressure steam is available, or where boilers which have been run at low pressure can be run at a higher pressure, to adopt the following policy: Provide steam engines to operate the fans and turn the exhaust steam into the heating coils—thus getting a double use out of the steam and cutting down the electric bill. This idea could be carried still further in many instances, and economies could be made (especially in the winter) by abandoning electric pumping, again lowering the electric bill. This is the stock argument of the advocates of isolated plants, who contend that great economies result in buildings of a million cubic feet or more if engines are installed and electricity is made on the premises. It is a fact that steam at high pressure only contains about 6 per cent more heat than steam at low pressure. Thus the argument that electricity can be made and a building heated with exhaust steam is advanced. The layman does not appreciate one very peculiar fact about steam: that at five pounds pressure it is only about 6 per cent cheaper to make than at 100 pounds pressure, showing that the cost does not increase in proportion to the pressure.

In the future it is probable that factories and loft buildings will be equipped with ventilating apparatus at the outset, with the ducts concealed in the walls and the fans located in the basement. A model building of this character has recently been completed in New York city, in which the landlord at the time of construction had the ventilating system installed at his expense, after the design of a prominent consulting engineer. Thus the cost of operating a system and the responsibility of maintaining it in good condition does not rest upon the tenant.

It is natural during this transition period and before the betterment of the standard of building construction has become general, that some differences are bound to arise between the Factory Inspection Bureau and the landlords and tenants. It is to be hoped that this condition is but temporary.

In the report of the United States Bureau of Labor at Washington, D. C., it is shown that deaths among factory workers due to consumption, were divided as follows:

Employees exposed to metallic dust...36.9 per cent
Employees exposed to mineral dust...28.6 per cent
Employees exposed to vegetable fiber dust .....24.8 per cent
Those exposed to animal and fiber dust.32.1 per cent

The occupation showing the highest consumption mortality was grinders, among whom 49.2 per cent of all deaths were from that disease.

An ingenious conclusion was reached by Mr. Frederick L. Hoffman, of the Prudential Life Insurance Company, based on this report. It is his opinion that by intelligent methods of ventilation and dust removal the consumption death rate among the wage earners would result in an annual saving of 22,238 lives. This would add, quoting the Engineering News, 15.4 years of life for every death from consumption avoided by rational conditions of industrial life. Such a gain would represent a total of 342,465 years of additional lifetime, and by just so much the industrial efficiency of the American nation would be increased. Placing the economic value of a year's lifetime at only $200, the total average gain to the nation would be $3,080 for every avoidable death of a wage earner from consumption, representing the enormous total of $68,493,000 as the annual financial value clearly within the range of practical attainment. Therefore, nothing within reason should be left undone as a national, State, and individual or social duty to prevent that needless but now enormous loss of human life from consumption due to the unfavorable conditions in American industry.

None will deny that the efficiency of workmen varies with their good health and comfort. Slight physical ills are prevented by better surroundings, and the loss to the employee due to absences, or brain made stupid by breathing foul air, are immediate losses to the employer through lowered efficiency, and later involve a loss of trained employees and the necessary breaking in of green help.

The Technical Utilization of Platinum.

Platinum is one of the most important substances used in modern industry. Its resistance to attack by strong sulphuric acid makes it a suitable material for the vessels employed in concentrating the dilute acid of the lead chambers, and until recently, states

Dancing menad, a fragment of a marble vase.
ARCHÆOLOGICAL RELICS FROM THE SEA.

Bronze lamp.

Umschau, platinum vessels were always used for this purpose. Its permanence in the air makes it suitable for contacts in electric bells, induction coils and the like, its resistance to the action of chemical reagents causes platinum to be employed in the construction of crucibles, evaporating dishes, scale pans, etc., as well as electrodes for experimental and technical electrolysis. Platinum is little affected by heating to a very high temperature and it is consequently used in the construction of electric resistance furnaces, in which temperatures exceeding 1,800 deg. F. are attained, and in Le Chatelier's pyrometer for the measurement of high temperatures. Another property of platinum which is of great practical importance is the approximate equality of its coefficient of expansion by heat to that of glass or porcelain. A platinum wire fused into a glass vessel will not produce cracks or leakage by unequal contraction in cooling or unequal expansion in subsequent heatings. This property is utilized by the makers of incandescent electric lamps, the carbon filaments of which are connected with the external circuit by short platinum wires, fused through the glass bulbs. For a similar reason the attachments of artificial teeth are made of platinum wire, which is baked with the porcelain mass in the kiln. Finally, the catalytic properties of platinum are utilized in various chemical industries, especially the production of sulphuric acid by the contact process, and in the construction of self-lighting gas burners, etc.

The Rising of the Aral Sea.

The rise which has been noticed in the Aral Sea is a difficult one to explain. It will be remembered that this body of water is one of the greatest lakes in the world, and in some places it has a depth of 220 feet. It receives the water of two large rivers, the Amu-Daria and the Syr-Daria, which bring to it about 2,000 cubic yards per second. During the last century it appears that the level of the lake has varied considerably. Starting from the middle of the century, we find that the level was lowered during 30 or 35 years, and this condition prevailed until after 1880, bringing about changes in the contour of the lake, and the islands became larger. However, we find that in 1899, when Berg explored the lake, it was now rising and had reached a much higher level, so that it overflowed some of the islands, and these had to be abandoned. On shore the railroad tracks had to be moved. The rise in the lake lasted until 1908, and we find that from 1880 to 1901 the level of the lake rose about 6.6 feet. Besides the Aral Sea we find that other lakes of the same region have also risen, so that the region of central Asia is far from undergoing a gradual drying up, as was supposed. Given the mean depth of the lake as 52 feet, the rise of 6.6 feet gives the addition of a mass of water representing one-eighth of the lake's contents. At the Barnoul observatory the rainfall is found to have kept at about the same point since 1875, so that we are at loss to explain the rise of the lakes in this region. In ancient epochs we find similar phenomena in different lakes as determined by geologists, but like the present one they appear to be unexplained.

OUR AERONAUTICAL ORGANIZATION.

BY C. M. CLAUDY.

Except for sporadic experiments, as at Fort Myer last year, for all the majority know to the contrary, the United States has done nothing in aeronautics. But the impression is erroneous. We have done all that we could do with the money there was available—more, indeed, than anyone thought we could.

Just what is our status, aerially, to-day?

To begin at the beginning, the aeronautical work of the government is all in the hands of the Signal Corps, an arm of the service charged with obtaining and conveying information, and opening lines of transmission of intelligence. Within the Signal Corps, of which Brig.-Gen. James Allen is chief, is the Aeronautical Division. This includes a number of officers, of whom Lieut. Frank P. Lahm is chief, under Gen. Allen, and enlisted men in squads of varying proportions, depending on the work to be done. Major G. O. Squiers is the theoretical expert. The strange proportion of men to officers of about two enlisted men to each officer, which obtains, is explained by the fact that the enlisted men do nothing but erect the balloons, or act as laborers for the towing or holding of aeroplanes. It is the officers alone who do the flying, and to whom is intrusted the actual aerial work. An exception to this was found last year when, on the death of Lieut. Thomas Selfridge in the Wright accident, and before Lieut. Lahm could get to St. Joseph, Mo., where the dirigible was located, Sergt. Ward went up in the dirigible with Lieut. Foulois, and while without experience, succeeded in operating the steering end with credit.

By name, the officers in the aeronautical corps are Lieut. Frank P. Lahm, Major George O. Squiers, Lieut. Benjamin D. Foulois, Lieuts. Winters, Bamberger, and Dickenson. Capt. Charles De F. Chandler is attached to the Signal Corps now as disbursing officer, but is available for aeronautical duty at any time. Of these officers, Lieut. Lahm has had the greatest experience, and he and Capt. Chandler are the two licensed pilots. Lieut. Foulois made a record with the dirigible last year. Winters, Bamberger, and Dickenson have each made a few flights in free balloons, but are still beginners in the art of aviation. Major Squiers has made an exhaustive study of the theory of aviation of all kinds and is an authority on the subject, although his practical experience is limited to a couple of balloon and one aeroplane trips.

The equipment with which the Aeronautical Division has to work comprises a balloon house at Fort Myer, and a balloon house of much greater capacity at Fort Omaha, where is also located a large electrolysis plant for the decomposition of water and the collection and storage of hydrogen, and the compression of it into steel tubes, for transportation. The Aeronautical Division has a number of spherical balloons, one dirigible, and will have at least one and possibly two aeroplanes before another year, being under contract to accept one from A. M. Herring and the Wright brothers, each, if they can satisfy the tests and conditions laid down by the Signal Corps in their original specifications.

The present equipment of the Aeronautical Division is neither large nor strong, but while it is used almost entirely for experimental and training purposes, it must not be supposed for a moment that it could not be used successfully in time of war. The spherical balloons, which can be used either captive or free, are just as able to take an observer aloft in time of war and for photographic or observation purposes, as in time of peace to give him aeronautical experience. The dirigible, while a small one—ninety feet long—has not a very large radius of action. Perhaps five hours in the air would represent its extreme of endurance. Yet it is perfectly efficient for the obtaining of information at a considerable distance.

The aeroplanes will be—one of them at least—the best of their kind in the world. Mr. Herring's machine is a mystery and no one knows whether it will be a success or not. But the Wright machine has demonstrated its efficiency.

Nevertheless, much depends upon who will run an aeroplane—as to how it will behave. The selection of Lieuts. Lahm and Humphreys to be the first aeroplane pupils is a wise one, not only because these gentlemen have had more actual aeronautical experience than anyone else in the army, but because they are both of them the type of men to make a success of any enterprise requiring quick thinking and action and cool nerves.

Perhaps the most interesting thing in connection with army aeronautics which the United States has to show, is the large balloon house at Omaha, which is capable of housing a very large dirigible, several hundred feet long, and of supplying it with gas. Just as soon as Congress sees fit to provide the money, we can immediately build a large dirigible, without having to wait for a balloon house. It is unquestionable that another and much larger balloon house, similar to or larger than the one at Omaha, will be erected at or near Washington. Indeed, Gen. Allen has expressed himself in favor of building it big enough to hold a Zeppelin. Meanwhile, there is the plant at Omaha, ready for the big dirigible when we shall get it. At present it houses the small one. The filling of steel tubes of one cubic foot capacity with 2,000 cubic feet of gas is a regular part of the work at Omaha, so that these tubes, transported from place to place, can afford facilities for erecting and flying either spherical or the dirigible balloon. Hydrogen, of course, has so much greater lifting power than coal gas, that its use is dictated always except for balloons of large size which have not to carry much weight. The "No. 9," seen in the photograph, is capable of making a free flight with two men although it holds but 9,000 cubic feet of gas, which provides a gross lifting power of 630 pounds. The "No. 10," which has a capacity of 80,000 cubic feet, will lift more than a ton, filled with coal gas, and with hydrogen would lift 5,600 pounds. To have hydrogen easily and quickly available, anywhere at any time, is a great part of the work of the electrolysis and compressing plant at Omaha, and the possession of this plant, as well as of the various balloons, dirigibles, and aeroplanes, goes far to give the United States at least a start in aeronautics, whereas we are popularly conceded to be simply a minus quantity.

The Testing of Intelligence.

BY OUR BERLIN CORRESPONDENT.

The multiplicity and diversity of those intellectual forces which individually or collectively are called intelligence, is only too often under-rated. In a recent memoir, E. Stransky draws attention to the error generally made in connection with scientific intelligence tests, so called, by choosing a single aspect of mental life as representative of its totality. It is a common mistake to mix up scientific training with intelligence, appreciating the mental capacity of a person according to the number and character of the notions assimilated at school and outside of it. Now, though a man, by frequently using abstract notions, gives evidence of a high intellectual capacity if these notions have been created by him, or at least acquired with a great deal of mental effort, those deriving the same notions from book reading do not necessarily show any productive superiority over lay people who have no occasion to deal with the same matters.

Generally speaking, it may be said that memory is by no means the only one, and still less, the most elevated of intellectual properties which, combined, make up the intelligence of a man. Again, memory is of two different kinds, possessing different value, viz., either *impressive* or *associative*, according as this faculty relates to the more or less durable impressions left by our perceptions, or to the system of intellectual associations by which new perceptions are united to the existing associative elements. Now, the former kind of memory obviously is far more primitive than the other, and cannot possibly be taken as a gage of intelligence. It is, in fact, generally known that adult persons, having assimilated a large amount of associative elements, are far from being so impressive as children, whose brains are as yet new. Moreover, the most intelligent persons often forget the most rapidly and absolutely what they have learned at school in a purely mechanical manner, even though these matters belong to their special branch. A celebrated physician, Dr. Billroth, has said in this connection that the "really educated people are just those who have forgotten more than others." The intelligence tests recently made in different countries on subjects chosen among the lower classes, have given especially instructive results in this connection by showing the frequently startling ignorance of the most common notions in the case of an individual perfectly capable by his mental capacities of earning his living and governing his house.

To this should be added that memory is only one of the different components of intelligence, and that judgment and power of combination are particularly important among the remaining functions of our intellect. Now, in appreciating the comparative mental forces of school children, this undeniable truth is only too frequently neglected, classification being merely based on the matters absorbed in a more or less superficial manner by the memory of the individual, and in everyday life we are unfortunately inclined to commit the same serious mistake.

In a previous memoir, the author has pointed out the individual diversity existing in the intellectual and psychical reaction to the outside world. There are thus individuals whose inner intellectual life in its extraordinary wealth cannot become fully evident, owing to a relative impotence of mental or merely linguistic manifestation. Another group comprises those who have not always at their disposal a frequently rather extensive knowledge. These individuals require tranquillity and, generally speaking, the concourse of circumstances propitious to their individuality in order to manifest in their entirety their knowledge, judgment, and imagination. They then become capable of accomplishing verily remarkable things, whereas when compelled to give evidence of their capacities and knowledge in a less propitious situation (at an examination, for instance) they are bound miserably to fail, and to appear dull, and even stupid. On the long way traversed by thought before its outside manifestation there are numberless obstacles sufficing to close against the outside world an abundantly gifted intelligence.

From what has been said will be understood what value may be ascribed to intelligence tests made according to a given scheme with watch or meter in hand, and which mainly relate to memory, promptness of repartee, and adaptability of the subject. It would certainly be interesting to test by a really scientific method also the mentality of those particularly gifted individuals whose intellectual life consists of combination rather than reception. Some methods have already been suggested in this connection; the late Dr. Ebbinghaus thus endeavored to use as gage the faculty of supplementing words, and on this basis the author has developed the method of "word deformation." However, all these methods, so far from showing the comparative value of intelligence, at most yield some information as to a given intellectual faculty.

Artificial and Natural Ice.

Natural ice, domestic or imported from Norway, was used exclusively in France twenty years ago. At present, three-quarters of the ice used in France is artificial, although the importers of ice have gradually reduced their price one-half. In interior French cities artificial ice has completely supplanted imported ice. Fifteen years ago considerable quantities of Norwegian ice were still brought to Paris, *via* Dieppe. This commerce has now entirely ceased, and Norwegian ice is used only in cities on or near the seacoast. The annual consumption of ice for cooling purposes in France amounts to 200,000 tons, of which 150,000 tons are manufactured. 4,500,000 tons of ice are used annually in the United States.

A French writer has recently suggested the imposition of a tax upon imported ice, in order to protect the manufacture of pure and wholesome artificial ice. He reminds his readers that this industry is of French origin. The French physicist La Hire first succeeded, in 1685, in freezing water by means of the heat absorbed when sal ammoniac is dissolved. In the nineteenth century another Frenchman, Bourgeois, constructed the first practical ice-making apparatus. In 1875 the method of transporting food in cold storage was created by Ch. Tellier.

Natural ice is not wholesome, as the majority of microbes survive temperatures of from —60 to —170 deg. F. Many sanitary casualties have been caused by the use of impure ice. An epidemic of typhoid fever in Rennes, in 1895, was traced to this cause.

In 1892, at the instigation of the Paris health board, the prefect of the Seine issued an ordinance which restricted the use of natural ice to industrial establishments and admitted as "edible" only artificial ice made either from sterilized water or water drawn from the city mains. Hence a protective duty of 6 francs per metric ton, or about $1.20 per ton, on imported natural ice is demanded.—Cosmos.

Official Meteorological Summary, New York, N. Y., October, 1909.

Atmospheric pressure: Highest, 30.59; lowest, 29.63; mean, 30.05. Temperature: Highest, 75; date, 8th; lowest, 35; date, 30th; mean of warmest day, 67; date, 8th; coolest day, 39; date, 29th; mean of maximum for the month, 59.8; mean of minimum, 46.7; absolute mean, 53.2; normal, 55.5; deficiency compared with the mean of 39 years, 2.3. Warmest mean temperature of October, 61, in 1900; coldest mean, 50, in 1876. Absolute maximum and minimum of October for 39 years, 88 and 31. Average daily excess since January 1st, 0.7. Precipitation: 0.74; greatest in 24 hours, 0.31; date, 23rd; average for October for 39 years, 3.58. Accumulated deficiency since January 1st, 2.64. Greatest precipitation, 11.55, in 1903; least, 0.58, in 1879. Wind: Prevailing direction, west; total movement, 9,396 miles; average hourly velocity, 12.6; maximum velocity, 46 miles per hour. Weather: Clear days, 15; partly cloudy, 8; cloudy, 8; on which 0.01 or more of precipitation occurred, 8. Thunderstorms, 23rd. Frost, heavy, 20th, 21st, 26th. Fog, dense, 10th.

An Inventors' Exhibition.

The Royal Würtemberg Chamber of Commerce is organizing a State exhibition of inventors' models to be held next year at Stuttgart. Its chief purpose is to help poor inventors who have little opportunity of bringing their inventions under the notice of likely purchasers. The directors of the affair promise that strict impartiality will be shown in the selection of exhibits, and that none will be accepted which is not worthy of serious consideration. There will be no expenses of any kind for the very poor inventor, and low fees for the others. It is not said whether the exhibition is expected to be self-supporting, but perhaps not, as the enterprise is being backed by the State.

Correspondence.

WHY WATCH SPRINGS BREAK.

To the Editor of the SCIENTIFIC AMERICAN:

Being a worker in tempered sheet steel, it occurs to me that the cause of broken main springs may be because the edges are not properly finished; that is, because there are short or small places on the edge that have not been ground and rounded on the edge since tempering. To overcome liability of cracks in band saws, I find it necessary to finish the edges. The breaks in the springs begin only at the edges, and I would suggest a more perfectly finished edge.

Lumberton, Miss. J. H. MINER.

MAGNETISM AND THE BREAKING OF WATCH SPRINGS.

To the Editor of the SCIENTIFIC AMERICAN:

Concerning the subject of breakage of main springs, allow me to contribute the following:

Every watchmaker has observed that at certain times a large part of his repair work consists of replacing broken main springs. And it is often observed that the spring is broken into as many parts as there were coils in the spring, and sometimes a fracture occurs every half coil.

The writer on one occasion, while wondering at the appearance of a spring broken up into half coils, noticed that the pieces were magnetized, and made a simple experiment of determining the polarity of the pieces by bringing the fractured ends together. He discovered that when the pieces were fitted together as they were in the original spring, the ends of the pieces at each joint were of like polarity. He then suspended a small soft-iron indicator from a single fiber of silk in a small material bottle, and by passing this indicator along the line of broken pieces of spring, discovered that the points of fracture were of alternate polarity. This was puzzling, for the ends of the pieces at each point of fracture should be of opposite polarity.

The writer has since caused a spring to be magnetized while coiled in a watch barrel, and on extending the spring found the points of polarity fixed in the spring, alternating every half coil.

Now it is evident that the repulsive force of like polarity at a point in each half coil has somewhat to do with the breaking of the spring.

When we consider that many springs, when wound up, are strained almost to the point of breaking, if we then subject them to the magnetic strain, the breaking as described does not seem so strange.

Jersey City, N. J. FRANK G. BURCH.

THE RENAISSANCE CLERGY AND SCIENCE.

To the Editor of the SCIENTIFIC AMERICAN:

The mention of the supposed papal bull against Halley's comet at its appearance in 1456 naturally suggests the consideration of the scientific work of that time. The universities were all in the hands of the ecclesiastics. In Italy particularly practically all of the professors were clergymen. In spite of the usual impression with regard to church opposition to science, this is a great period in the history of science. Though it is not usually realized, the Renaissance affected science quite as much as it did arts and letters. During the century from 1450 to 1550 the foundation of much of our modern science was laid. In the Archives of Diagnosis (New York, April, 1909) I called attention to the fact that to a man of this period, the famous Cardinal Nicholas of Cusa, we owe the first hint as to the use of accurate methods in diagnosis in medicine. There were no watches, for the "Nuremberg eggs" were not made until the next century, and the taking of the pulse had been very indefinite. Cardinal Nicholas suggested that the amount of water passing through a water clock during one hundred beats of the pulse should be weighed, and compared with the amount of water that flowed through standard water clocks, in normal and abnormal cases of various kinds. He suggested that the same thing should be done for the respirations. He also declared that specific gravity in the study of the urine and blood would surely be of value. Prof. Karl Bins of the University of Bonn called attention to this some five years ago in the Berlin Medical Journal.

It seems surprising at first that such thoroughly scientific suggestions for medicine should have come at the middle of the fifteenth century. A review of the scientific situation during the latter half of the century, however, showed how natural they were. Cardinal Nicholas himself wrote a series of books on mathematics. It is in one of these on mechanics that his suggestion with regard to medicine occurs, and he touched many other important scientific questions. He declared, for instance, that "the earth cannot be fixed, but moves as do the other stars." He denies that it can be the center of the universe. He was sent on diplomatic missions by the Pope, and while riding in his carriage it is said that he thought out the problem of the cycloidal curve from studying the motion of a fly on the wheel, and solved this curve. Cantor, the great German historian of mathematics, gives him some thirty pages, a whole chapter to himself. His greatest contemporary was Regiomontanus, the father of modern astronomy. Regiomontanus introduced the use of the tangent into mathematics. He was invited to Rome by the successor of that Pope Calixtus who is said to have issued the bull against the comet, to become the papal astronomer. Cantor gives him a very important place in the history of mathematics. Antonius the Archbishop of Florence was another contemporary, and his monograph on comets contains a number of interesting anticipations of ideas that did not get into astronomy until after Galileo's time. Galileo was rather inclined to think comets appearances in our atmosphere. Antonius thought them far distant. At this time Puerbach was teaching mathematics and astronomy at Vienna, and translating the Alexandrian mathematicians and astronomers from Greek into Latin for the universities of that time. A little later Novara was doing the same thing at Padua. When Copernicus, having completed his studies at Cracow, wanted to do graduate work in astronomy and mathematics, he went down to Italy. Before the end of the fifteenth century he announced his new theory of the universe. Within the same decade Columbus gave the men of his time a new world, and Copernicus what his bishop friend Ferber declared to be a new universe.

Medicine woke up as the result of the touch with old Greek medicine, just as mathematics and astronomy did. Italy was the home of graduate teaching in this as in all the other sciences. Linacre and Caius and Free from England went down to Italy to study anatomy and clinical medicine. Berengarius was teaching at Bologna, Benivieni at Florence, and Leonicenus at Vicenza, and modern medicine was receiving a great new impetus. During the century from 1450 to 1550, the Renaissance century (which we Americans should call Columbus's century) all our modern anatomy came into being. The work on it was all done in the eccelsiastically ruled universities of Italy. Vesalius, Varolius, Columbus the anatomist, Eustachius, Caesalpinus, and Piccolomini, with Fallopius and many others, did their work in the peninsula. Most of them were professors of anatomy at Rome. Eustachius, whose name is attached to several structures in the human body; Columbus, who discovered the circulation in the lungs; Caesalpinus, who first described the circulation of the blood in the body; and Varolius, after whom important structures in the brain are named, were all papal physicians. Chemistry and pharmacology woke up in the persons of the monk Basil Valentine and his great successor Paracelsus.

To think of the latter half of the fifteenth century as a time when there was lack of interest in science or any suppression of scientific aspirations, is to be ridiculously ignorant of what actually occurred; for the chapter of the Renaissance of science when the Greek masters were rediscovered and translated for the modern world is quite as important as the story of humanism or the new learning, when the Greek literary texts touched the genius of the modern world to that outburst of new thought that made one of the most interesting periods in the world's history. A little more study of science history, and not of the supposed religious history of the time, shows how utterly without foundation is the squabbling over religious intolerance.

JAMES J. WALSH,
Dean and Professor of the History of Medicine,
Fordham University Medical School.

New York city.

A New Nitrous Product.

At Mülhausen, Alsace, there is being manufactured a new nitrous product for use as fertilizer, in the shape of a nitride of aluminium, the combination of nitrogen and aluminium being obtained by a new process invented by M. Serpek. The inventor first studied the preparation of carbide of aluminium which he obtained in the form of yellow crystals by heating a mixture of alumina and carbon in the electric furnace. This carbide, like the other carbides with which we are acquainted, has the property of fixing gaseous nitrogen and thus gives nitride of aluminium. To obtain an economical production of this latter, he does not isolate the carbide of aluminium, but after the formation of this body in the electric furnace it is at once mixed with a fresh quantity of alumina and is then treated with nitrogen gas. He thus obtains masses which contain 20 to 24 per cent of nitrogen, and this can be used at once as fertilizer. Under the influence of atmospheric oxygen and moisture we have ammonia given off, which is transformed by bacteria into nitrates and alumina. The inventor is working the new process in a small factory which he installed, and has realized some interesting results during the last year. He now produces crystallized nitride of aluminium which has a high percentage of nitrogen—as much as 34 per cent. An advantage of his process is that we do not need to use pure nitrogen which requires an expensive plant of Linde or other machines, but the gas from the producer is employed, this containing 77 per cent of nitrogen and 23 per cent carbon monoxide with a little carbonic acid. Thus we have a very simple and rapid process for the crystallized nitride, and owing to the various advantages, it may compete with cyanamide.

The Migrations of Mackerel and Herring.

Although the mackerel fishing season usually ends in October, thousands of mackerel have been caught after October in recent years in the English Channel. In November, 1901, a bank was discovered which often yielded a catch of six tons in two or three hours. Several similar winter assembling places have since been discovered. It had previously been assumed that mackeral seek the North Atlantic in winter, and return in spring to the North Sea and the coasts of Cornwall and Brittany, but these new discoveries indicate that they do not migrate, but simply seek greater depths in the same locality for their winter resting places, where they remain assembled during the day. At night they disperse in search of food and are consequently seldom caught in the nets.

Localized schools of herring have also been discovered in recent years. There may be migratory schools as well, observes Prometheus, but it appears certain that the herring is a more sessile fish than has hitherto been assumed. During its first year, or until it attains a length of 4 or 5 inches, and probably until its length has increased to 8 or 9 inches, at the end of the second year, it remains near the place of its birth. After the second year it begins to appear sporadically. At all seasons the waters of the English Channel contain adult herring which are evidently of the same breed with the young fry of spring. Even in winter a few herring are caught, but only at great depths, although large numbers are caught near the surface in summer. The assumed migration of herring to Arctic waters is made doubtful by the discovery of these sessile schools. This discovery also explains the existence of the distinct local races, which are recognized by the fishermen, and which always reappear on the same fishing grounds at the breeding season.

"Cork Metal."

BY F. J. WILLOTT.

At one of the recent aeronautical exhibitions samples of a metal were shown under the name of "cork metal," which was said to be 40 per cent lighter than aluminium, and to have numerous other properties which should make it a rival of the latter.

Great secrecy was maintained as to the nature of this wonderful metal, but its properties were such as to rouse my interest, as a consequence of which I have submitted it to chemical analysis.

In appearance the metal resembles very strongly the alloys known as magnalium. The surface presents a lusterless whitish gray color, both sheets and bars showing the scorings and scratches so frequently found on badly rolled or drawn aluminium. Careful analysis gave the following result:

Aluminium	5.04 per cent
Iron	0.017 per cent
Zinc	0.48 per cent
Sodium	0.21 per cent
Magnesium	99.30 per cent

It will be seen therefore that essentially "cork metal" is nothing but magnesium to which a small amount of zinc has been added. Whether this latter has been purposely introduced or, as is more probable, is merely present as an impurity, I am unable to say.

As the metal evolves hydrogen when immersed in water, I found it necessary to use organic solvents for the determination of the specific gravity. In alcohol this was found to be 1.762, thus confirming the conclusion that cork metal is, in fact, magnesium.—Chemical News.

The Current Supplement.

Of the two chief constituents of the atmosphere, we have hitherto been accustomed to look upon oxygen as the fundamentally important element. Nitrogen, however, is of vital importance; so important, in fact, that the task of finding out and opening up new sources of nitrogen compounds has become one of the most interesting and pressing problems of the day. The subject is well discussed in the current SUPPLEMENT, No. 1767, by Mr. A. Bernthsen. The Schneider torpedo-testing station is elaborately described and illustrated. Mr. Snowden B. Redfield describes the making of automobile tires. The stars are due to fall on the nights of November 12th to 14th, a fixture in the celestial schedule of events. The display is called the Leonid shower, and is discussed in the current SUPPLEMENT. A new gas-electric motor car for the Third Avenue Railway Company of New York city is illustrated. The article on the Paris Aviation Exhibition is concluded. The usual engineering notes, electrical notes, and trade notes will be found in their accustomed places.

MAKING ALCOHOL FROM WOOD WASTE.

A middle West industry, for which a great future is promised, is that of the manufacture of alcohol from sawdust, shavings, slabs, and other refuse of the lumber mill.

Rumors of improved methods and great economies in the manufacture of wood alcohol have been "in the air" for some time, and we have received a number of inquiries on the subject from subscribers and correspondents. We are glad, therefore, to be able to give now some details of the new process, for which patents have recently been granted to Mr. Malcolm F. Ewen and Mr. George H. Tomlinson of Chicago.

It has long been known that ethyl alcohol and other valuable by-products could be made from wood waste in laboratory experiments, and many processes have been developed, but practically none of them has reached the stage of economic success on a commercial scale.

One of these aroused the interest of Mr. John M. Ewen, better known as a constructional steel work engineer and manager of the Fuller Construction Company, builders of so many "skyscrapers." Although it was not found practicable commercially, Mr. Ewen was so much impressed with the possibilities of cheap alcohol from wood waste that he spared enough time and energy from his other great responsibilities to continue independent investigations, and it is largely owing to his personal and financial support that the present successful process has been developed, one of the patentees being his brother.

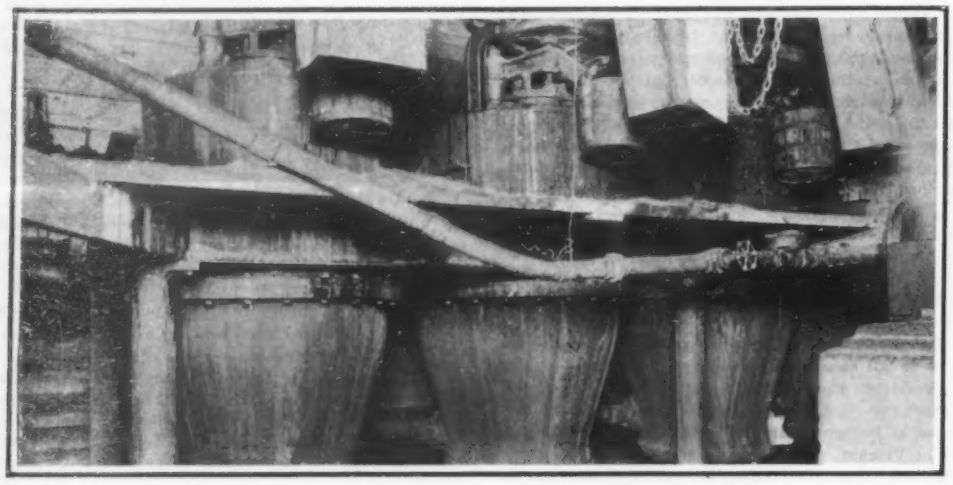
Lumbermen have long been alive to the necessity of finding a use for the appaling piles of waste they are compelled annually to destroy, if only as a means of additional profit, before the question of conservation of natural resources became of national interest. In addition, there are many and various uses to which alcohol is applicable with advantage, and from which it has hitherto been excluded by its cost.

All kinds of internal-combustion engines, for instance, can use alcohol as fuel with advantage over gasoline and with very little modification.

One of the greatest advantages of the production of a pure alcohol from wood, however, will be the release for food purposes of the millions of bushels of corn and barley now consumed in the manufacture of grain alcohol.

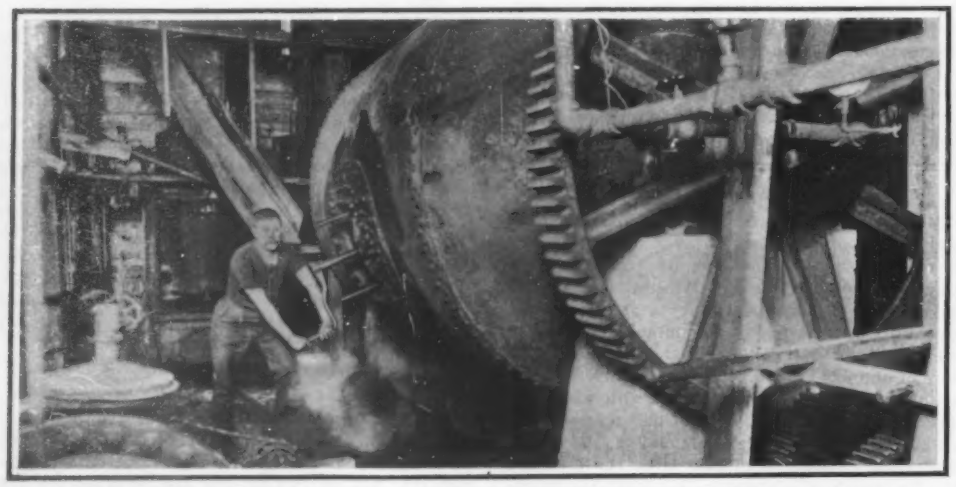
The price of grain alcohol is at present $2.60 a gallon at 188 proof, of which $2.07 is internal revenue tax, the net wholesale price being only 53 cents. Corn worth 26 cents is required for the manufacture of a

(*Continued on page 359.*)



A diffusing battery of four units.

One of the large tanks in which the wood pulp is fermented.



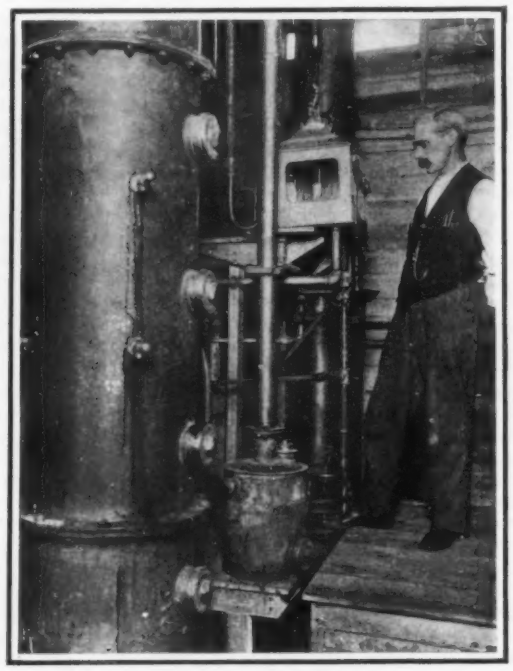
The digesting machine which performs the functions of a mechanical stomach. It converts the starch of wood waste into sugar.

TRIALS OF THE NEW "DREADNOUGHT"—"NORTH DAKOTA."

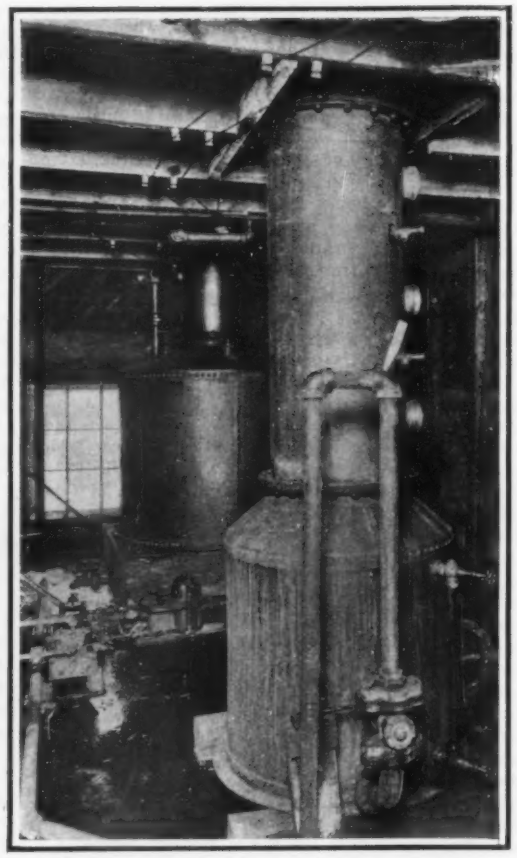
In view of the fact that the first two "Dreadnoughts" to be built for the United States navy are identical in everything except motive power, the "Delaware" being driven by reciprocating engines and the "North Dakota" by Curtis turbines, an unusual amount of interest has been aroused by the recent speed trials of these two ships. The "Delaware," which was built by the Newport News Shipbuilding Company, was tried out over the course off Rockland, Maine. She is equipped with Babcock & Wilcox boilers, and in the five trial runs for standardization of her propellers, which were made over the mile course, she developed a maximum speed for one mile of 21.98 knots, a mean speed for the five runs of 21.44 knots; a maximum horse-power of 30,000, and a mean horse-power of 28,578.

The "North Dakota" is not only an exact duplicate of the "Delaware" in the form of her hull and in the displacement, but in common with that ship is equipped with fourteen Babcock & Wilcox boilers. Consequently, the Navy Department was in a position to make a most exact comparison of the efficiency of the respective motive power, all the conditions except

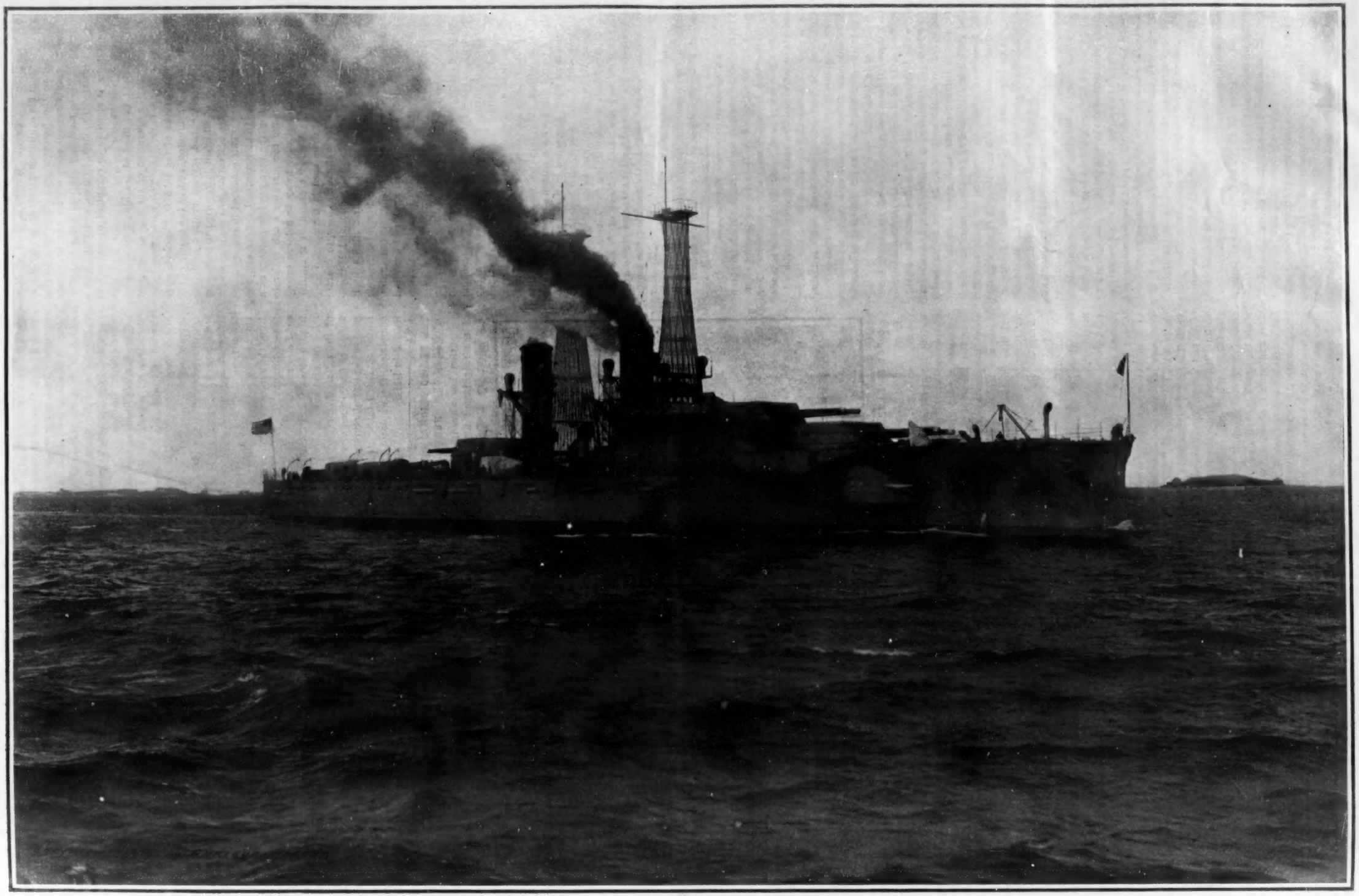
(*Continued on page 360.*)



Reading the thermometers.



Still by which a fine grade of ethyl or grain alcohol has been made out of sawdust and slabs.



Length, 518 feet, 9 inches. **Beam,** 85 feet, 2⅓ inches. **Mean draft,** 27 feet. **Displacement on trial,** 20,000 tons. **Speed on trial,** 21.86 knots. **Horse-power,** 33,875. **Coal supply,** 2,500 tons. **Armor:** Main belt, 10 inches to 12 inches and 7 feet 6 inches wide; upper belt, 10 inches to 8 inches and 8 feet wide; barbettes and turrets, 11 inches. **Armament:** ten 12-inch forty-five caliber guns; fourteen 5-inch fifty-caliber guns.

UNITED STATES BATTLESHIP "NORTH DAKOTA"; FASTEST "DREADNOUGHT" AFLOAT.

The Wright Brothers and Their First American Pupils.

On November 4th Orville Wright arrived at New York fresh from his exhibition flights at Berlin and at Potsdam before the Emperor and Empress. During his stay he taught several army officers how to operate his biplane. These machines are now being manufactured in Germany, England, France, and Italy, and a large company is about to be organized to make them in the United States.

Wilbur Wright has finished teaching Lieuts. Lahm and Humphreys the operation of the new government biplane at College Park, Md. The aerodrome is located beside the tracks of the B. & O. Railroad, some eight miles from Washington, and in the course of the lessons the aeroplane had several brushes with the express trains, all of which it is reported to have won easily. An important modification was made a month ago by Wilbur Wright. This consisted in removing the upper surface of the front horizontal rudder and rigging it just in front of the rear vertical rudders as a tail. It is said to make the machine much easier to control, and also that it does away to a large extent with pitching. Orville Wright changed in a similar manner the machine that he used in Germany.

After being taught for a fortnight how to operate the government biplane, Lieuts. Lahm and Humphreys, on October 26th, made their first flights in it alone. Lieut. Humphreys made the first flight, which consisted of two circuits of the field, in 3 minutes. Lieut. Lahm next flew six times around, and described some small circles as well, his time being 13 minutes. Lieut. Humphreys then made another flight of 8 minutes. On October 30th both officers had been flying for 10 minutes when the gear that drives the magneto dropped off, causing the engine to stop. The machine glided safely to earth. On November 1st, after making an excellent 16-minute flight, Lieut. Lahm remained aloft 58½ minutes. Two days later Lieut. Humphreys, with Lieut. Foulois as passenger, flew 61¾ minutes, and came within 10¼ minutes of equaling Orville Wright's record flight with a passenger. Lieut. Lahm, after one false start, succeeded in making an 8¾-minute flight with Lieut. Sweet, who weighs 185 pounds and whom Wilbur Wright had twice tried to take up in a calm without accomplishing it. Lieuts. Humphreys and Foulois made another flight of 25 minutes. On November 5th, when Lieuts. Lahm and Humphreys were making a flight early in the morning, the motor began missing, and the machine got dangerously near the ground. The end of the lower plane struck in making a turn, and the machine was rather badly smashed, although neither of its occupants was hurt.

An Electrolytic Scrap Tin Process.

The electrolytic method for extracting tin from scrap is quite extensively used in Italy at the present time. An alkaline bath is used in most of the factories. For the anode tin scrap is used, while the cathode is made up of plates of iron. The bath is a soda lye which is kept at a high temperature. Oxidation of the tin at the positive pole produces stannic acid, which is transformed to stannate of soda by combination with the soda of the bath. This stannate of soda is reduced at the negative pole, and here the tin is deposited. Soda is re-formed in this way.

Considered theoretically, the electrolysis should have the effect only of depositing the tin at the negative pole, while leaving iron at the positive pole, the liquid of the bath not changing in composition, and no gas being given off at the electrodes. It was found, however, that a heating of the bath gave a much better result, which is explained by the lowering of the electrical resistance when the temperature rises and by the greater solubility of the stannic acid in the caustic soda at high temperatures. Thus in order to facilitate the chemical and electrolytic phenomena the liquid is heated and given a rapid circulation in the direction of the current. The reactions are easily produced at the positive pole, owing to the great surface of contact of the anode and the bath, but such reactions are less easily produced at the cathode, whose surface is much smaller. Therefore at the beginning of the operation there is formed an excess of stannate of soda and its quantity keeps on increasing. When the percentage of stannate exceeds a certain value determined by experience, the bath is not sufficiently alkaline to allow of the good progress of the actions. Some of the liquid is then removed and replaced by soda lye. When the operation is well carried out, there is but little hydrogen set free at the negative pole and nearly all the oxygen enters into reaction at the positive pole. The amount of gas given off shows an indication as to the working of the process, and the end of the extraction of the tin coincides with the greatest disengagement of gas.

In Italy the tanks generally used are made of iron and have about 100 cubic feet capacity. The liquid is made to circulate rapidly between the re-heater and the tanks by a pump. The six anodes which are used are formed by perforated iron holders containing the tin scrap, while the seven cathodes are made of plates of iron. The tin is thrown down on the cathodes in a spongy state which adheres but slightly and can be collected by scraping off. The powder thus secured is washed and then compressed in cylindrical cakes, which are kept under water in order to prevent oxidation. The cakes are melted in a furnace of the kind which is used for bismuth. A part of the tin is oxidized during the operation. The metal is then recuperated by a reducing treatment of this oxide in a reverberatory furnace.

The iron obtained at the cathode does not contain more than 0.1 per cent of tin when the process is well carried out, and this iron is of a very good quality and is sought for by iron works. It is this part of the process which makes the present method of tin extracting economical, for unless the iron can be used in metallurgy the case would be otherwise, as is true for other tin extraction methods. The stannate of soda taken from the bath is then transformed to bioxide of tin, and to carry this out we filter the liquid taken from the tanks and a current of carbonic-acid gas is passed through it. There is formed thus carbonate of soda and stannic acid, and this latter is roasted so as to give bioxide of tin, this product being used in ceramics and also in the chemical industry for manufacture of tin salts. At present there is used in Italy from 50,000 to 60,000 tons of tin, the greater part of which goes to the manufacture of tin cans. The scrap is estimated at 11,000 tons. As soon as the new works are completed, the whole of this amount of scrap can be treated in Italy.

THE RECORD FLIGHTS OF COUNT DE LAMBERT AND HENRY FARMAN

Mention has already been made in these columns of the magnificent flight of Count de Lambert on a

COUNT DE LAMBERT FLYING NEAR THE EIFFEL TOWER.

Wright biplane from the Juvisy aerodrome to Paris and above the Eiffel Tower. In the present issue we reproduce a photograph showing the aeroplane flying near the tower at a high elevation. After circling about the aerodrome a couple of times in order to reach a height of some 450 feet, Count de Lambert left it at 4:37 P. M. on October 18th and flew straight for Paris, passing over Chevilly and Villejuif and entering the city by passing over bastion 81, about 180 feet to the left of the Arcueil gate. From this point he curved to the left and kept steadily ascending, so that when he reached the Eiffel Tower he was at a height of some 400 meters (1,312 feet), or 100 meters (328 feet) above the top of this lofty edifice. After passing over it he described a wide semi-circle, and returned to Juvisy along the same route. He alighted at 5:30 P. M. less than a score of feet from his shed, and was heartily cheered by the crowd of spectators who had witnessed his departure and return. The total length of the flight was 49 minutes 39 seconds, and the distance covered close to 30 miles. The air-line distance from the aerodrome to the tower is about 12½ miles, but the course followed by Count de Lambert was a couple of miles longer, to which must be added the circuits of the aerodrome at the start and upon the return. When congratulated upon his magnificent performance by Orville Wright (who had just arrived from Berlin), Count de Lambert was very modest and had but little to say. The chief impression was the slow speed at which he seemed to be traveling when flying at a great height, and the well-nigh interminable time before he finally reached again his starting point. Although his flight was one of the most daring that has thus far been made, the Count did not treat it as such, and he seems to have made it without any great trepidation. As a spectacular feat in aviation it stands unsurpassed up to the present, although Farman's new endurance record, made at Mourmelon November 3rd, was probably of more importance from a practical point of view.

While competing for the Michelin trophy last week Wednesday, Farman flew continuously for 4 hours, 6 minutes, and 25 seconds, during which time he covered 232 kilometers (144 miles) at an average speed of 35.06 miles an hour. Thus he has actually covered in a single flight a distance as great as that from New York to Albany, which we stated some time ago we believed him capable of covering if he had seen fit to revisit America and participate in the contest held during the Hudson-Fulton Celebration. This contest, which is for a prize of $10,000 for the first aeroplane or dirigible that flies from New York to Albany, is to be held open until October 9th, 1910.

The motor used by Farman in his latest record-breaking flight is the same one that he used in winning the long-distance contest at Rheims. It is a Gnome revolving-cylinder motor of 50 horse-power, having 7 cylinders that revolve in a vertical plane around a stationary crankshaft. In a brake test made by the Aero Club of France, this motor developed only 34 horse-power and ran for 2½ hours; Farman has had, however, greater success with it, as evidenced by his excellent flight. Both Paulhan and Sommer, as well as Farman, have also made excellent flights recently upon Farman biplanes at the recent aviation meetings at Blackpool and Doncaster in England. The revolving-cylinder motor seems to have worked well in every instance, and to have demonstrated its reliability.

The Michelin trophy was brought to America last week by the president of the Aero Club of America as a result of Wilbur Wright's flight of 2 hours 20 minutes on December 31st last at Le Mans. When asked whether he thought it would remain here, Wilbur Wright is said to have replied that the winner for this year must be prepared to fly from dawn till dark; so in all probability Farman's record will be considerably beaten before the year is out.

As the trophy can only be competed for between 10 A. M. and sunset, however, if the flight for it is not made until the last day of the year, it cannot be of more than of six or seven hours' duration.

Disinfectants in Water Purification.

At the annual meeting of the New England Water Works Association one paper dealt with the extensive studies which have been in progress for some years at the Laurence Experimental Station, and another recorded some interesting results obtained at the Poughkeepsie water works. At the Laurence establishment many disinfectants have been tested, including copper salts, permanganate of potash, and calcium chloride. Unlike copper salts, both of the latter reagents are rapidly decomposed; they effect a considerable reduction in the number of bacteria present; and the resulting compounds are of harmless character from the physiological standpoint. Recent experience at Poughkeepsie relates chiefly to the employment of calcium chloride, which has been found beneficial in preparing the water for filtration. The general tendency to-day in water purification is toward reduction of the work to be performed in filters. British endeavors of this class are mainly confined to the provision of storage reservoirs where partial purification occurs by natural agencies, while American engineers more generally attempt to hasten the process by means of coagulants and disinfectants, alone or in combination. The papers mentioned are worthy of consideration, but we think the British method of preliminary treatment generally preferable, especially for waters already characterized by a fairly large proportion of mineral salts.

The Russian Secret Service and Aeronautics.

The Russian government views with alarm the advent of the airship or aeroplane. Evidently the fear that some aeronautic nihilist may possibly drop a bomb upon the Czar's palace has wrought up the government to a pitch of nervous fear. The Minister of the Interior has given the following instructions to his subordinates:

1. All ascents of flying machines and airships are to be carefully watched by the police.
2. All the aero clubs of Russia must be registered, and their members are subject to supervision by the secret police.

A good example of the economy often accomplished by chemical investigation and discovery is furnished in the case of ultramarine. Many years ago when this was made by powdering the mineral lapis lazuli, it sold for more than its weight in gold. Now that the chemist has discovered how to make the same material from such cheap substances as kaolin, sodium sulphate and carbonate, charcoal, sulphur and rosin, the price is only a few cents per pound.—American Machinist.

Handy Man's Workshop

A SIMPLE METHOD OF LAYING OUT A SUN DIAL.

BY F. WILLARD BROWNE.

The sun is a very poor timekeeper. At this time of the year it is about a quarter of an hour fast, while in February it will be nearly fifteen minutes slow. For this reason we do not take time from the real sun, but from an imaginary sun which comes to meridian every twenty-four hours exactly on the second. There are only four days in the year when the real sun is on time, viz., April 15th, June 15th, September 1st, and December 25th. A sun dial records the real sun's time and not the mean sun's time, and consequently is a very poor timepiece for actual service in these days. However, it makes a very attractive ornament, and readers of Handy Man's Workshop may find it interesting to make a simple dial. It is popularly supposed that the laying out of the sun dial face is a difficult matter, but this can be done without the use of mathematics if the difference between the real solar time, the mean solar time, and standard time is clearly understood. Noon, strictly speaking, is the moment when the sun comes to meridian; that is, when it is due south of the observer. As we have just stated, if we depended upon the real sun to mark the noon hour, some of our days would be shorter than others. Our watches would have to run anywhere up to thirty seconds a day fast and slow at different times of the year, in order to keep pace with the real sun. The imaginary sun which keeps perfect time is not much better for general purposes because noon would be different to different observers. A man in New York would have different time from a man in Brooklyn. A commuter from the Oranges would have to set his watch ahead about a minute when going to business and back a minute when returning home. To avoid all this complication we take our time from the mean noon at certain fixed meridians just 15 degrees apart. The eastern section of the country gets its time from noon at the seventy-fifth meridian west of Greenwich; central time is taken from noon at the ninetieth meridian; mountain time, from the hundred-and-fifth meridian; and Pacific time from the hundred-and-twentieth meridian west of Greenwich. Bearing these facts in mind, we can proceed to lay out our dial without the use of mathematics on the four days above referred to when the real sun and the imaginary sun come to meridian at the same time.

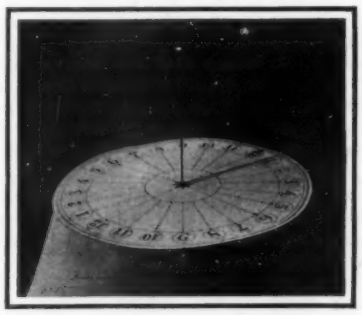


Fig. 1.—A SUN DIAL FOR USE AT THE NORTH POLE.

First of all, it is absolutely necessary that the line casting the shadow on the dial face shall be absolutely parallel with the axis of the earth. This being the case, it makes no difference what the position or form of the surface receiving the shadow may be so long as it is rigid. Our problem resolves itself therefore into the question of how we shall provide for the placing of this shadow-casting line.

It is perfectly apparent that at the North Pole this line would occupy merely an upright position, and a dial for such a situation would be similar to Fig. 1. At the southern extremity of the earth's axis a similar instrument would be required, except that the hour marks would have to number round in the opposite direction.

At the equator an apparatus similar to Fig. 2 has been devised. If the shadow-casting line is to be parallel to the earth's axis, it is evident that at this point it must be perfectly horizontal and pointing north and south. Just here it may be of interest to call attention to the fact that at the equator the sun always rises and sets at six o'clock. The most convenient surface to receive the shadow from a line placed as above described would be the interior of a half cylinder; and if this were equally distant at all points from said line, the hour marks would be twelve equal divisions of its surface. This same form of sun-dial could be used at any latitude, provided it has an arrangement for canting it up (Fig. 3) so as to maintain the position of the axis line parallel with the earth's axis.

In latitudes midway between the equator and the poles a horizontal form of sun-dial is most commonly used, and we will construct ours according to that model.

Fig. 4 affords a general idea of the method of construction. The material should be well-seasoned pine for the baseboard, which may consist of two pieces of ¾-inch stock measuring 10½ by 6 inches each, with two 12-inch cleats to correspond. In the preparation of the gnomon or shadow-casting piece *A B C*, the essential feature is that the angle at *B* shall invariably correspond in degree with the latitude of the locality where the dial is to be placed. For instance, since Boston is 42 deg. 21 min. north latitude, angle *B*, if the dial is to be used in Boston, must be a shade over 42 1/3 degrees; at New York the angle *B* should be 40 3/4 degrees.

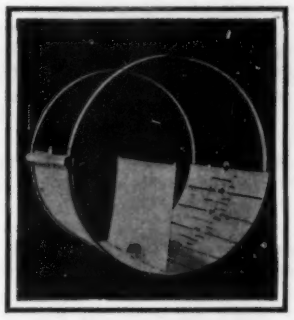


Fig. 2.—A SUN DIAL SUITABLE FOR USE AT THE EQUATOR.

The base line of the gnomon should be at least long enough to extend two-thirds of the way across the board. If our dial is to be for indoor use only, the shadow piece may be constructed of heavy bookbinder's pasteboard, but for outdoor exposure it had better be made of brass or heavy galvanized sheet iron. Make a paper pattern, and get your tinsmith to cut it out for you. The out-of-door sun dial should receive at least three good coats of the best white lead paint as a protection from the weather.

Having reached this point, and having assembled the various parts, fastening them securely in place with screws or good wire nails, we are now ready to make our markings upon the dial surface for the twelve or fourteen hours of daylight during which our sunshine clock will be of service. These may be made temporarily with lead pencil, and afterward lined in with waterproof ink or good black paint.

It is very essential while placing these lines, of course, that the dial shall remain in an absolutely fixed position, and that the gnomon shall point exactly north and south, as it ought always to do if our time is to be at all accurate. Now, without a surveyor's compass how shall we accomplish this? Mean solar noon in Boston is at sixteen minutes of twelve o'clock. By that we mean that at 11:44 the imaginary sun is directly in the south; and if at noon on Christmas day or any other of the four days above mentioned when the imaginary and real suns coincide, we place our dial so that the gnomon, with angle *B* toward the south, casts at either side no shadow whatever, the shadow that extends from the edge of the gnomon marks the hour of XII. At 12:44 a line drawn along the shadow will be the I o'clock mark of the real solar time. With a reliable timepiece in hand we may thus proceed to make the necessary markings as the hours go by, being careful of course to see that the position of the instrument has not been altered. The morning hours will bear the same relative distances from XII on the opposite side of the dial.

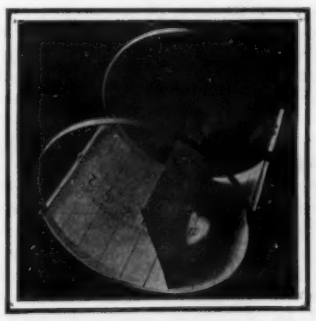


Fig. 3.—A CONVEX DIAL TILTED TO THE ANGLE OF ITS LATITUDE.

To find the difference between mean solar time and the standard time for any locality apply the following rule: Ascertain the difference in longitude between the given place and the meridian of the standard time of that locality, as indicated by the following table:

Colonial time is mean solar time of 60th meridian
Eastern time is mean solar time of 75th meridian
Central time is mean solar time of 90th meridian
Mountain time is mean solar time of 105th meridian
Pacific time is mean solar time of 120th meridian

Multiply the number of degrees of difference in longitude by four, and the result will be the difference of time in minutes.

If the standard meridian is the larger of the two, mean solar noon will occur just as many minutes before 12 o'clock standard time. If it be smaller, the time will be so many minutes later.

To illustrate:

The meridian of eastern time is 75 deg.
Longitude of Boston is 71+ deg.

4 deg.
Multiply by 4

16 minutes.

The meridian of eastern time being the *larger*, therefore mean solar noon will occur at 16 minutes *before* 12 o'clock, and the sun dial must be placed so that the gnomon casts no shadow at that time.

Should it be thought desirable to construct a vertical sun dial to be attached to the southern wall of a house, for instance, the same principles apply as we have already laid down, only be sure to bear in mind that the essential angle of the triangular gnomon is always the one farthest to the south, and not the one resting against the baseboard. It is more than probable that the wall to which the dial is to be fastened does not face exactly south, so that it will be necessary to bend the gnomon slightly to the east or west, in order to get the proper direction for its upper edge.

Having had good success in the construction of one or more sun dials made according to the foregoing suggestions, possibly it may be thought desirable to construct something of a more permanent nature, and the following directions in regard to the use of concrete for that purpose may be of service.

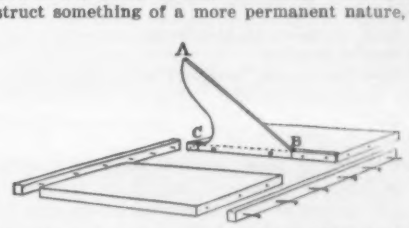


Fig. 4.—CONSTRUCTION OF A HORIZONTAL DIAL.

In making a mold for the construction of the plane portion of the dial, one of two methods may be followed. Make a shallow box the exact size and shape of this part of the dial. Before the bottom board is fastened on, draft upon its interior surface a reversed tracing of the markings of a previously constructed dial, giving of course also the hour-mark figures. These may now be gone over with a V-shaped chisel if raised markings are desired, or they may be built up with modeler's wax if figures indented in the stone surface are thought to be more desirable. A thin but tapering piece of board should be fastened at the point where the gnomon is to be inserted later on. The entire mold should now be thoroughly gone over with tallow, to prevent the concrete mixture from sticking at any point.

A good concrete for our purpose may be made of two parts sand and one of Portland cement. These should be thoroughly mixed before water is added. About 20 per cent of water is supposed to be about the right proportion to use, but a better rule to follow is to continue to add water until the mixture has such a consistency that tapping upon it with a flat trowel will bring water to the surface. The concrete should be allowed to set for five or six hours before the moldboards are removed, and, by the way, these should have been fastened together with screws. After this the stone should be kept moistened every hour or two for two or three days to obtain the best results. Another method of making this part of the dial, though the result might not be quite satisfactory, would be to fill a shallow box with concrete, working the markings into the surface before it has begun to set very much.

The gnomon may be made of iron by your blacksmith neighbor, in which case it ought to undergo some treatment to prevent its rusting; or it may be cast of brass from a wooden model. Having this firmly cemented in the groove provided for it, we have now a dial ready for whatever surroundings may seem desirable. Concrete stone may be rendered impervious to the action of water or frost by the following treatment: First, wash it thoroughly with a hot solu-

tion of Castile soap, and after rubbing in and drying, apply a solution of alum.

Since the color of the concrete may not be wholly satisfactory for receiving the shadow of the sun, the upper surface of our stone may be kept painted with lead paint or with an insoluble whitewash.

EXPERIMENTAL COLOR MAKING WITH SIMPLE CHEMICAL SOLUTIONS.

BY A. J. JARMAN.

Color manufacturing to-day is carried out upon a very large scale, and so cheaply that it has often been considered quite impracticable for the amateur to prepare his own colors; but one should bear in mind that the colors so produced are of absolute purity, containing no adulteration whatever. Furthermore, there is not only an elementary knowledge of chemistry obtained, but a useful and valuable product, at the cost of a very small outlay.

The following colors can be easily made, without the use of special chemical vessels, the one essential point being that all the water used should be filtered, so as to free it from organic matter and mechanical impurities, in the form of iron rust, and sometimes small fragments of carbonate of lead, obtained from the lead supply piping.

The following solutions must be made in clean glass bottles, half a dozen strips of glass half an inch wide and ten inches long, and half a dozen or more of common glass tumblers, and a few sheets of white blotting paper.

In the clean bottles make up the following chemical solutions:

1. Iodide of potassium, 120 grains dissolved in 10 ounces of water; a label being placed thereon with the name of the chemical.
2. Bichloride of mercury, 120 grains dissolved in 10 ounces of hot water, and allowed to become cold.
3. Two drachms of nitrate or acetate of lead dissolved in 10 ounces of hot water.
4. Half an ounce of protosulphate of iron dissolved in 10 ounces of water.
5. Half an ounce of ferricyanide of potassium (*red* prussiate of potash), also dissolved in 10 ounces of water.
6. Half an ounce of bicarbonate of soda dissolved in 10 ounces of water.
7. Two drachms of nitrate of silver dissolved in 10 ounces of distilled water.
8. Half an ounce of bichromate of potash dissolved in 10 ounces of water.

Now having all these chemical solutions made, proceed as follows: Pour into one of the tumblers two or three ounces of the bichloride of mercury solution, then add carefully half an ounce of the iodide of potassium solution; stir well with one of the glass strips, when instantly a beautiful deposit of scarlet vermilion will be formed.

Be careful not to add too much iodide solution, because this scarlet vermilion is soluble in a solution of iodide of potassium, which may become partially or wholly re-dissolved. If this is the case, continue to add more of the bichloride of mercury solution, when the precipitate will return. Always have the mercury solution in *excess;* this will do no harm. The precipitate, or scarlet vermilion, is known chemically as *iodide of mercury.*

The iodine, which was chemically bound up with potassium, was freed when the iodide solution was mixed with the bichloride of mercury solution; there being a greater affinity between the iodine and mercury than between iodine and potassium; hence the change. So iodide of potassium and bichloride of mercury, when brought together in solution, form *iodide of mercury* and chloride of potassium.

To purify the color so produced, all that is necessary is to allow the precipitate to subside, pour off the clear portion (this contains the chloride of potassium which is held in solution), pour upon the precipitate some clean water. Allow it to subside. About four such washings will remove the impurity. Then fold a piece of white blotting paper, about ten inches square, so as to form a quarter of the sheet. Open the fold, pour into it the wet precipitate, wash out the tumbler, pour the washings into the blotting filter, and place the blotting filter into another tumbler, or into the same one, if more convenient. When the precipitate has become well drained, it may be allowed to dry, or be used in a moist condition by adding a few drops of gum arabic mucilage, being well incorporated with a bone or hard rubber paper knife upon a piece of ground glass, or when dry, ground with a pestle in a small mortar, and used as desired. The above description of filtering will apply to *all* the following colors.

Pale lemon yellow is made by pouring two or three ounces of the lead solution into a clean tumbler, and adding half an ounce of the iodide of potassium solution. Stir the mixture well; the pale yellow precipitate being *iodide of lead.* Wash the precipitate, and filter as for the vermilion.

Lemon chrome is made by the following mixture: Three ounces of lead solution is poured into a tumbler, and two ounces of the bichromate of potash solution poured into it. Stir with a clean glass strip. The beautiful rich yellow precipitate is chromate of lead.

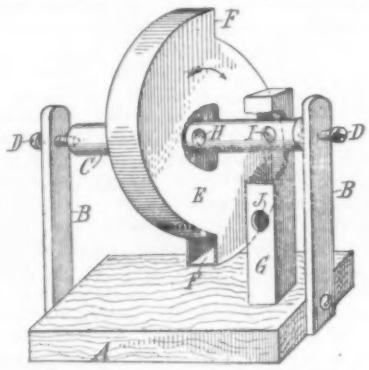
The chromic acid of the bichromate of potash has combined with the lead of the lead salt (owing to the greater affinity of these two bodies), so that chromate of lead is formed, and acetate or nitrate of potash is formed as the result of chemical combination. Wash the precipitate and filter as before, *always* using a fresh filter paper for each precipitate. Pure white, or carbonate of lead is made as follows: Pour two ounces of the lead solution into a tumbler, add about one ounce of the bicarbonate of soda solution; a dense white precipitate of pure *carbonate of lead* is formed (white lead); the precipitate being washed and filtered as before. In this case the carbonic acid, from the bicarbonate of soda, has attacked the lead from the acetate of lead solution, carbonate of lead being formed, and acetate of soda.

Prussian blue is formed by the following mixture: Take three ounces of the red prussiate of potash solution in a clean tumbler; pour into this about three ounces of the protosulphate of iron solution; instantly a dense, beautiful, rich blue precipitate is produced; stir this well; the resulting precipitate is Prussian blue. In this case the cyanogen that was combined in the red prussiate of potash has seized the iron of the protosulphate and formed *cyanide of iron,* while in the clear solution, when the precipitate subsides, is held the sulphate of potash formed by the reaction. This precipitate will take some time to subside. Never mind this; wash this precipitate as before, when it will be found that there is one of the finest blue colors produced that it is possible to obtain. A beautiful rich brick red is made by pouring into a tumbler four ounces of the nitrate of silver solution, then add thereto three ounces and a half of the bichromate solution; stir this well with a glass strip; stir it vigorously, because the precipitate is apt to be rather coarse if stirring is not well attended to. This precipitate is chromate of silver, a very permanent color. Although the term brick red is given to it, it is more of a purple red, a color in fact that cannot be produced by any other means. By preparing the above colors one's self, there is not only great pleasure derived, but a knowledge that can only be obtained by experiment.

AN INTERESTING PARADOX.

BY C. S. BOURNE.

In the demonstration of truths of a scientific character, it is sometimes surprising to an experimenter to



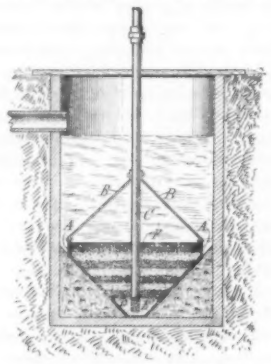
WHICH WAY WILL THE AIR FLOW?

obtain results seemingly opposed to what we conceive to be a natural sequence of means employed. Thinking it may interest some of the readers of the Scientific American, I give the details of a small apparatus which I constructed some time ago. As shown in the accompanying engraving, the device comprises a baseboard *A*, from which rise two supports *B B*. A hollow shaft *C* is supported at each end by means of screws *D*, threaded through the vertical supports. Mounted on the shaft *C* is a hollow drum *E*, consisting of two semi-cylindrical portions eccentrically connected to form the offsets *F* at opposite sides of the drum. These offset portions are open, and provide communication with the interior of the drum. Close to one of the supports *B* is a box or air chamber *G*, through which the shaft *C* runs. The shaft *C* is provided with an aperture *H*, communicating with the interior of the drum, and an aperture *I*, communicating with the interior of the air chamber *G*. An opening *J* provides communication with the outside air. I have asked a number of persons to predict the result of rapidly rotating the drum in the direction of the arrow (which was done in this case by drawing a cord wound on the shaft), and all have stated their belief to be that the air would be drawn into the drum, and would pass through the shaft into the air chamber, issuing from the aperture *J*. In fact, the result is a current in the opposite direction, as can readily be demonstrated by holding a piece of paper before the opening *J*. The paper will be sucked inward. The explanation, of course, is that the centrifugal force of the air in the drum more than balances the condensing power before the apertures *F F*.

FILTER FOR CISTERNS.

BY CHARLES BRECHT.

The accompanying illustration pictures a method of filtering the water in a cistern so as to make it fit for drinking. This filter may be applied to any cistern by simply filling the cistern with stone or concrete in such a manner as to get an inverted conical or pyramidal bottom. The device comprises a basket *A*, adapted to fit into this conical bottom. The basket is preferably made of sheet iron or steel of light gage, and to prevent it from rusting should be galvanized. The basket



A CISTERN FILTER.

should be attached by means of straps *B* to the pump pipe *C*. A wire screen *E* fits across the bottom of the basket, and is secured to the pipe *C* just above the perforated bottom section of the pipe. This forms a small chamber *D*, in which the filtered water collects. Above the screen *E* are placed layers of filtering material, consisting first of coarse gravel over which is laid fine gravel and then a layer of fine sharp sand. Above this a layer of charcoal should be placed; then a layer of fine sand, a layer of coarse sand, a layer of fine gravel, and finally a layer of coarse gravel. Over this is placed a coarse wire screen or perforated plate to keep the mass in place.

The idea of this arrangement is to do away with any contamination of the water by filtering it only as it is used. The wide top of the filtering basket provides a large filtering area, while the apex allows as small a volume as possible to stand in the filter basket and become brackish in case of a long drought. This small amount may be thrown away if it is found unfit for use and fresh filtered water quickly obtained, at the same time keeping as large a reserve above the filter basket as the size of the cistern will permit.

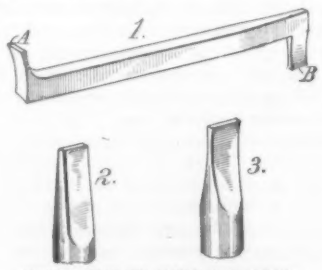
A CLOSE-CORNER SCREW DRIVER.

BY HERBERT S. DAVIS.

The screw driver here illustrated will be a welcome addition to anyone's kit of tools, as sometimes in a close space one cannot turn a regular screw driver with any degree of satisfaction, whereas with this screw driver by using first one end and then the other the screw can be tightened up nicely.

In use it somewhat resembles an angle wrench. Take a piece of ¼-inch square tool steel, about 4½ inches long, and heating it to a fair heat bend one end over and form a lip as shown at *A*, Fig. 1. Then, turning it one-quarter way round (this is done so that the other end clears the work when using) bend the other end and shape it as at *B*. Dress up the blades with a file, making them slightly hollow back of the edge of the lip which should be a good 1/64 or 1/32 inch thick. Then harden it at as low a heat as possible, and temper to a strong blue.

One need not confine himself to this size of steel. The device can be made lighter or heavier to suit various requirements.



CLOSE-CORNER SCREW DRIVER.

Right here a word on the shape of a screw-driver blade may not be amiss. Most of the screw drivers the writer has seen have lips of wedge shape as shown in Fig. 2. When made like this they have a tendency, when in use, to climb out of the slot and damage it so that it is difficult to tighten or loosen the screw.

The blade should be made as in Fig. 3, slightly hollow back of the lip. When made this way it will catch in the bottom of the slot and will not ride out.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

FORM-GAGE.—EDITH R. SEXTONE, Chicago, Ill. In this patent the invention has for its purpose the provision of a gage suitable to obtain the shape and measure of different sized and proportioned women, for the construction of bust forms and stands upon which to drape their clothing.

ATTACHMENT FOR WEARING-APPAREL.—A. GOLDBERG, New York, N. Y. By means of this attachment the waist dimensions of garments can be altered to adapt them for use by persons having different waist measurements; it obviates the use of a draw string; requires no alteration in the garment to permit its use in connection therewith, and is inexpensive to manufacture.

GARMENT-RACK.—B. HARSKOWITCH, New York, N. Y. This rack supports a plurality of garments. Two members are employed, one of which is normally fixed and the other which is normally movable, and these members are so connected together that the movable member may be pulled out longitudinally together with the garments supported thereby and may then be rotated to better display the garments.

HAT-GUARD.—C. H. SHAW, New York, N. Y. This invention is an improvement in hat guards, and the inventor has in view such a device in which the guard string will be automatically drawn within the hat when released and the effective length of the string altered to suit the convenience of the wearer.

Electrical Devices.

ELECTRIC DETONATOR.—G. A. ALLEN, Western Springs, Ill. More particularly the invention relates to detonators of the type operated by aid of electricity, the more particular purpose being to guard the explosive materials and exclude the entrance of moisture, so as to preserve in good condition the priming and other explosive substances contained within the detonator shell.

Of Interest to Farmers.

INCUBATOR.—E. A. MAISCH, Anderson, Cal. In this electrically heated incubator the invention relates more particularly to the construction of the heating coils and the egg-supporting trays. Means provide for an even temperature at all parts of both trays; only a small quantity of current is consumed and the contrivance requires only a simple method of regulation.

BEET DIGGER AND TOPPER.—W. C. MAUER, Greeley, Colo. This improvement is in beet diggers and toppers, and the device is especially adapted for digging and topping sugar beets, which are generally planted in elevated ridges, and at spaced distances apart. Beets below a certain size are culled or rejected and the remainder must be topped at the crown.

Of General Interest.

EXERCISING APPARATUS.—W. P. STULL, McKeesport, Pa. In using the apparatus, it is clasped in the hand with the thumb on one grip and the fingers on the other, and the hand is opened and closed, with the arms pendent, extended, and bent to the shoulder, or with any other movement of the arms, advisable or desirable. At the same time the body may be bent into various positions.

ADVERTISING DEVICE.—J. E. DOWSING, New York, N. Y. In this instance the invention has reference to advertising devices admitting of general use, and more particularly to a type of advertising device suitable for campaign purposes with a view of attracting the attention of the public to a particular candidate.

DOOR-HANGER.—F. J. S. MIELY, Gunnison, Colo. This invention relates to door hangers and especially to such as are employed for hanging sliding doors such as car doors, barn doors, and the like. The object is to provide a track of improved form which will be reliable in operation, and further, to provide improved means for supporting the track.

Hardware.

STRAINER.—T. RICHARDSON, New Orleans, La. This device is for application to faucets for straining water and other liquids and thereby removing wigglers, bugs, and other solid particles. The object of the invention is to provide in such a device a detachable straining element, which is easily applied and displaced for cleansing and other purposes without removing the device from the faucet.

NUT-LOCK.—T. HAND, Walla Walla, Wash. This form of nut lock is much stronger, more rapidly applied and removed and may be manufactured at much less cost on account of its simplicity, there are no key holes or cavities to become clogged, it automatically adjusts itself to a constantly tightening position and may be removed by simply exerting a holding strain on a lug by a crow-bar, pick, or other tool, if the wrench should not be available.

MITER-BOX.—W. E. SHUTTS, Ellenburg Center, N. Y. This inventor provides a box wherein the saw is guided to operate at a variety of angles from the perpendicular, while operating at various angles on horizontal planes. The operative positions may be readily and quickly adjusted, and means provide for regulating the depth or extent of cutting of the blade.

Heating and Lighting.

BOILER-TUBE CLEANER.—J. D. THOMPSON, Eureka, Cal. The object here is to provide a cleaner for tubes, which is adapted for directing a jet of steam through the boiler tubes from their rear, it being possible to use the cleaner without dismantling the boiler or furnace in any manner and without drawing the fire from the furnace.

ELECTRICALLY-OPERATED WATER-HEATER.—J. A. HUNNEWELL, Lowell, Mass. The more particular purpose of the inventor is to provide a type of heater containing a minimum of parts, the latter being so arranged that water passes through a long tube containing a heating coil, the cold water entering at one end of this tube and the hot water being drawn from the opposite end of the same.

VACUUM AIR-VALVE.—C. A. DUNHAM, Marshalltown, Iowa. This invention pertains to certain improvements in vacuum air valves intended for use in connection with vacuo-vapor heating systems, or for any class of heating work in which it is desired to vent air from the mains, returns, or other portion of the system in which low pressure steam is used.

Household Utilities.

WINDOW-SHADE SUPPORT.—C. C. BROWN, Revelstoke, British Columbia, Canada. The object of this invention is to provide a new and improved window shade support, arranged for convenient up and down adjustment on the window, to allow moving the shade roller to any desired height, and to permit convenient manipulation of the window shade.

FLUSH-TANK.—B. WALKER, JR., Austin, Texas. The improvement refers to flush tanks, and the aim is to produce a tank having a valve of simple construction which will operate to close automatically after the water of the tank has run off. A further object is to provide an improved construction for controlling the main lever of the tank which operates the flush valve.

FOLDING CRIB OR BED.—E. GUNDELACH, New Rochelle, N. Y. The intention in this case is to provide a crib or bed, which is simple and durable in construction, exceedingly strong and cheap to manufacture, and arranged to permit of conveniently folding it into a comparatively small bundle for transportation or storing purposes.

JAR-OPENER.—J. H. SMITH, Rochester, N. Y. The object of the invention is to provide an opener for jars containing fruit, vegetables and other food stuffs, and arranged for convenient application to pry the closure open, with a view to break the vacuum in the jar and the adhesiveness of the closure to the jar, thus permitting convenient removal of the closure.

Machines and Mechanical Devices.

REINFORCEMENT FOR BOOK-LEAVES.—F. H. CRUMP, Los Angeles, Cal. The main purpose here is to strengthen the binding edges of loose sheets to such an extent that the sheets may be moved upon the posts or other binding mechanism without mutilation. Another purpose is to provide a binding edge which will be of the same thickness, after reinforcement has been applied, as the main body of the sheet.

SPEEDOMETER.—E. SCHNEIDER, XV. Staglgasse 8, Vienna, Austria. The speedometer, according to this invention, is connected to an ordinary clock work, which couples a spindle to an indicator device intermittently for a definite period of time, so that the index of the indicator is set in accordance with the speed of the spindle at the time.

COIN-SORTER.—T. F. GALLIGAN, Providence, R. I. This apparatus is for use in automatically separating coins according to their several denominations. It has coin delivery openings successively decreasing in size, from the top to the bottom passage, according to the size of the coins, a coin carrier in each passage, means for sweeping the coins into the pockets of each carrier and means for revolving the carriers to finally carry those coins remaining in the pockets over the several denomination outlets whereby the coins drop through by gravity.

SAUSAGE TWISTING AND LINKING MACHINE.—W. J. COLLINS, New York, N. Y. An object in this case is to provide a simple and efficient machine which can be driven from any suitable source of power, and which forms sausage links of uniform length. The links may be also formed of different lengths without danger of tearing or injuring the same, and the machine twists the casing so tightly that it cannot subsequently untwist.

TRIGGER MECHANISM.—E. R. WILLIAMS, St. Joseph, Mo. The purpose of the inventor is to provide a mechanism provided with a very sensitive auxiliary trigger on the usual or main trigger, to securely lock the main trigger and hammer in firing position, and to permit an easy and quick release of the hammer for firing purposes.

Prime Movers and Their Accessories.

COMBINED TIMER AND DISTRIBUTER.—G. T. BROWN, New York, N. Y. This invention is for use in connection with multi-cylinder internal combustion engines for controlling the passage of the spark at the igniter. The casing is supported rigidly so that there can be no movement whatsoever, and upon the central shaft the inventor provides a helical contact member movable longitudinally of the shaft and rotatable therewith. The pitch of the helix and position of the helical member on the shaft determine the time of closing of the electric current.

STARTING-CRANK FOR INTERNAL-COMBUSTION ENGINES.—J. A. LAWSON, New York, N. Y. This invention pertains to improvements in cranks for internal combustion engines, and more particularly to an improved means whereby the crank may be locked to the shaft by the mere act of grasping the handle of the crank, and whereby the releasing of the handle will release the grip of the crank upon the shaft.

COMBINED TURBINE MUFFLER AND FLY-WHEEL.—J. A. LAWSON, New York, N. Y. Mr. Lawson not only utilizes the pressure of the gas, but he prevents the high temperature of the gas from injuring the wheel rotated thereby. This wheel is so constructed as to operate as a fly wheel, and furthermore he utilizes the wheel in creating a partial vacuum at the exhaust valve or valves of the engine during the cranking or starting of the engine.

Pertaining to Vehicles.

HANDLE-BAR FOR BICYCLES.—J. R. LOGAN, Fresno, Cal. The intention in this case is to provide a bar for bicycles which serves as a receptacle, in which the hose employed in connection with a pump for inflating the tires may be stored. By stowing the hose, it is always at hand ready for use, and by utilizing the bar, a receptacle is provided, which is not in the way and adds but little cost to the handle bar.

WEAR-STRIP FOR CART AND WAGON BODIES.—J. T. HAMILTON, Council Bluffs, Ia. The invention relates to vehicles used for carrying grain and similar material which may leak out at the rear of the vehicle body. The invention strengthens the parts at this point, renders them more durable, and operates positively as a preventive of the waste of grain by leakage.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12129) F. A. McD. says: There has recently been brought out an electrolytic alternating current rectifier, consisting mainly, I understand, of aluminium electrodes immersed in a solution of aluminium chloride. If you have ever published any account of the construction of this apparatus, or know of any such description having been published, I would be pleased to have you advise where I may find the same. A. You will find the electrolytic rectifier described with plans for its construction in SUPPLEMENT Nos. 1478, 1644, 1679, and in the SCIENTIFIC AMERICAN, Vol. 97, No. 8, and Vol. 101, No. 7. We send these papers for ten cents each.

(12130) C. C. says: I have quite a lot of dry batteries. They have gone dead. Is there any way they could be charged or worked over to put some life into them? A. Nothing can be done for dead dry cells to revive them "as good as new." Sometimes holes are punched in them and they are put into jars as wet cells, getting some current out of them. Sometimes the top is cut out and fresh solution of sal ammoniac is put in. The strength and life of the renewed cell are not enough to pay for the labor and cost.

(12131) J. R. says: Will you kindly tell me how much per house-power is the selling price of electricity when it is generated and sold to consumers. I ask this question for the purpose of framing a lease for a water power which we are trying to have improved. A. The price of electricity in this city is 10 cents per kilowatt hour, either for power or lighting purposes. The kilowatt is the more usual unit of measurement because it may be more conveniently estimated simply by multiplying the voltage of the current by the amperage, e. g., 10 amperes of 250-volt current gives 2,500 watts or 2½ kilowatts; 746 watts, or ¾ of a kilowatt nearly are equivalent to one horse-power, or one kilowatt = 1 1/3 horse-power. The price varies in different parts of the country, being higher at remote coal-burning plants where fuel is expensive, and lower at hydro-electric generating stations where power costs nothing. The highest price we know is 22 cents per kilowatt hour, and the lowest 5 cents, the New York price above quoted being about the average and a fair price to estimate upon.

(12132) C. R. says: Allowing that a man weighing 300 pounds and 3 ounces weighed 300 pounds by spring balance—3 ounces being lost in centrifugal force at sea level, equator—what would he weigh at the North Pole, with 13 miles less of earth under him? I say 295 pounds, as there is less matter to attract. What would he weigh at the top of a mountain 5 miles high, equator? Would he weigh less than 300 in or over the deepest (5 miles) ocean, equator? That is, does the water attract as vigorously as earthy matter? Will the SCIENTIFIC AMERICAN get a sea captain to try a common ball with spring balance at sea level, New York, and then over the deepest ocean abyss? A. The weight of a person at different places on the earth is calculated by the application of Newton's law of gravity. The weight is directly proportional to the attracting mass, and inversely proportional to the squares of the distances between the centers of gravity. The results obtained show that a body will weigh about 1/190 part *more* at the poles than at the equator. (See Young's "General Astronomy," Chapter V.—The Earth as a Globe. We can send the book for $3, postpaid.) The centrifugal force at the equator is 1/289; hence, a man or other body really weighing 300 pounds would seem to weight a trifle less than 299 pounds at the equator, because of centrifugal force. The loss given by you as 3 ounces is too small. At the poles a man whose real weight is 300 pounds at the equator would weigh 301.5 pounds. The earth's mean diameter may be taken as 7,917.6 miles, as given by Young in his latest book. The oblateness of the earth is usually taken as 26 miles. From these figures you will see that the equatorial radius is 3,965.3 miles and the polar radius is 3,952.3 miles. You may disregard the fraction and use only the whole numbers. At the pole there is a little less matter to attract a body, and for this reason it would weigh a little less, but at the same time it is brought nearer the center of the attracting body. It is 3952/3965 as far from the center, and hence the attraction $(3965/3952)^2$ times as great, and the weight is increased to the same degree. The weight on the top of a mountain 5 miles high at the equator would be $(3965/3970)^2$ times the weight at the sea level. We do not know what change of weight there would be over the deepest ocean. Pendulum experiments to determine this are not easy on a ship, nor is accurate weighing very easy on shipboard—certainly not the accurate weighing of a large weight. Balances for weighing heavy articles are not sensitive enough to determine the weight to a small fraction of a unit. We may say that the water attracts less than the rocks of the earth, since it is less dense than the rocks. We must leave you with these explanations to figure out the results, since we do not solve problems for correspondents, as you will see by referring to our Hints to Correspondents.

(12133) H. L. T. says: Some years ago I heard of an instrument used by architects to determine the extent of the sun's shadow for any given condition, at any particular season of the year. Could you inform me who manufactures or sells this instrument? I have made inquiries from a number of the prominent supply houses without success. A. We do not know any instrument especially for determining the sun's shadow. This can be drawn by a protractor when the altitude of the sun above the horizon has been determined. To find the altitude of the sun for any day at noon, when the shadows are shortest since the sun is highest, you should have the latitude of the place and the declination of the sun. Subtract the latitude of the place from 90 deg. To the remainder add the declination from March 21st to September 21st. From the remainder subtract the declination from September 21st to March 21st. This gives the angle of altitude of the sun at noon above the southern horizon. With this angle, the shadow cast by any object can easily be drawn.

(12134) F. Electric Company says: Can you favor us with receipt of formula for the silvering of lens mirrors, such as are used for marine searchlights on projectors? A. You will find in our SUPPLEMENT No. 1,671, price ten cents, full and accurate directions for silvering glass for mirrors. The method is the one now in general use by precipitating silver upon the glass from a solution. With cleanliness and care, good results are not difficult to obtain.

(12135) J. D. asks: Are you aware of any plan being discovered how the pyramids of Egypt were built? A. We believe that authorities upon Egyptian antiquities are agreed as to the probable method of handling the stones of the pyramids and the much larger statues and obelisks which were moved hundreds of miles and set up in place. Man power alone can have done the work, and it does not seem necessary to suppose any unknown modes were used for doing the work. With men enough, all can be accounted for. Frescoes exhibit such work going on. Some have thought that earth was filled in to form an inclined plane as the pyramid was raised to the higher portions, and the stones were then slid up this plane, which was removed after the building was completed. In modern times such stones have been moved long distances by man power. The base of the statue of Peter the Great in St. Petersburg was

dragged from Finland to its present location by men. Its weight is estimated at 2,000 tons. Iron rails were laid upon which cannon balls rolled, and thus the huge block was drawn by men.

NEW BOOKS, ETC.

KRIECHTIERE UND LURCHE DEUTSCHLANDS. By Dr. Kurt Floericke. Kosmos Gesellschaft der Naturfreunde. Geschäftsstelle Franckh'sche Verlagshandlung in Stuttgart. Price, 50 cents.

In this book Dr. Floericke has presented a popular account of the principal reptiles and amphibians of Middle Europe. To those who are familiar with the German language and desire to obtain a general knowledge of an interesting class of animals without delving into technical details, the book can be recommended.

THE FIXED LAW OF PATENTS. By William Macomber. Boston: Little, Brown & Co., 1909. Large 8vo.; pp. 1,060. Price, $7.50 net.

In this work Mr. Macomber has presented in digested form the patent statutes, the decisions of the Supreme Court of the United States, and the decisions of the nine Circuit Courts of Appeals, the three constituting what Mr. Macomber calls "The Fixed Law of Patents." As a piece of compilation and arrangement the book is indeed admirable; as a reference work for the patent lawyer it will be extremely helpful. The principles of patent law, although fairly few in number and simple in essence, have in later years become more or less befogged in the effort of non-technical judges to administer the patent law fairly. In view of that fact, any attempt to bring something like order out of a chaos of decisions is certainly commendable. Because the book gathers up the appellate law, in the language of decisions, it should be of interest to the specialist. Unless he has digested the law for himself, the specialist will hardly have such a compilation. Considered as a whole, the work may be regarded as an orderly statement of the courts' language in important cases, and therefore absolutely authoritative.

INNS AND TAVERNS OF OLD LONDON. By Henry C. Shelley. Boston: L. C. Page & Co., 1909. 364 pp. Price, $3.

The subject of inns and taverns in London has always been a fascinating one, and the literature concerning them is quite voluminous. The present volume sets forth the historical and literary associations of those haunts, together with an account of the most notable coffee houses, clubs, and pleasure gardens of the British metropolis. The English have always had a reputation of being essentially a home-loving people; still in the seventeenth and eighteenth centuries they seem to have exercised considerable zeal in creating substitutes for that home which they ought to have loved above all else. When the Londoner had procured his taverns and inns, he set to work evolving a new species of public resort in the coffee house. That type of establishment appears to have been responsible for the development of the club as the substitute for the home, and then came the age of the pleasure garden. Both of the latter survive, the one in the form of a more rigid exclusiveness than the eighteenth century Londoner would have dreamed possible; the other is so changed that frequenters of the latter would scarcely recognize the relationship. The engravings are taken from old prints, and are of great interest. The book is beautifully printed and most attractively bound.

IMAGINATION IN BUSINESS. By Lorin F. Deland. New York: Harper Brothers, 1909. 18mo.; 108 pp. Price, 50 cents net.

This little book contains a number of shrewd essays which deal with a curious phase of business. It shows the remarkable part which imagination plays in business, especially to-day.

LIGHT AND HEAVY TIMBER FRAMING MADE EASY. By Fred T. Hodgson. Chicago: Fred J. Drake & Co., 1909. 12mo.; 395 pp. Price, $1.

The present work is a copious treatise on the modern practical methods of executing all kinds of timber framing, from the simple scantling shed or lean-to to the heavy and complicated timber bridges, centers, needling, and shoring, roughing and railway work, tank frames and taper structures, and is illustrated by 450 engravings and diagrams.

THE ROMANCE OF MODERN MANUFACTURE. By Charles R. Gibson. Philadelphia: J. B. Lippincott & Co., 1910. 12mo.; 320 pp. Price, $1.50.

In the present volume the author has endeavored to trace the evolution of the different industries, and to describe in everyday language the methods of modern manufacture in all of the principal industries. It deals with textile machinery, laundry machinery, needle machinery, thread machinery, shoe machinery, manufacture of pottery by machinery, paper making, manufacture of books, artificial light, manufacture of confectionery, the mechanical baker, clocks and watches, manufacture of iron, making steel rails, the railroad and the locomotive, building a ship, and other chapters. The illustrations and diagrams are particularly clear, and we are glad to note a number of the best ones have appeared first in the SCIENTIFIC AMERICAN, and that they are reprinted properly credited.

MACHINE DRAWING AND DESIGN FOR BEGINNERS. By Henry J. Spooner, C.E. New York and London: Longmans, Green & Co., 1908. 8vo.; 266 pp.; 743 illustrations. Price, $1.25.

The author is director and professor of mechanical and civil engineering in the Polytechnic School of Engineering in London, and is the author of valuable works on drawing and machine design. The work is an excellent one, and the drawings which are reproduced are thoroughly common sense. Of course, English practice is slightly different from American, but the differences are not so great as to militate against the value of this book. The questions suitable for examination and home work are valuable, but the Board of Education examination papers are worthless for American students.

AN EXPERIMENTAL STUDY OF BAGASSE AND BAGASSE FURNACES. By E. W. Kerr, M.E., assisted by E. M. Percy, B.S. Baton Rouge, 1909. 8vo.; 106 pp.

During the last few years the writer, who has charge of the instruction of students in the engineering branches of the Audubon Sugar School, has visited a large number of sugar factories in Louisiana for the purpose of gathering data and information for classroom use. In these visits he has been particularly struck with the lack of uniformity in the methods employed for utilizing bagasse as a fuel, both as to the form and proportions as well as to the manipulation of the furnaces. With a view to standardizing as far as possible the methods employed, it was decided to conduct a series of investigations, the object of which should be to gain a thorough insight, by general observation and by tests, into the methods used in Louisiana for utilizing the heat from bagasse. The result of the labors of the author is included in the present pamphlet, which gives his views on the subject most exhaustively and reflects great credit upon the author.

LABORATORY NOTES ON IRON AND STEEL ANALYSES. By Walter Macfarlane. London and New York: Longmans, Green & Co., 1909. 12mo. 462 pp. Price, $2.50 net.

These notes were in the first instance written for the guidance of the staff in an iron and steel works laboratory, which was for some years under the supervision of the author, and where the results of over 40,000 estimations were annually placed on record. The methods required to be reliable and rapid, so as to control and keep pace with the manufacturing operations. It was necessary that all the analysts should work on identical lines, and the accuracy of the methods were tested in daily practice and confirmed by other analysts. These notes have been explained and published, and are for the benefit of all students. The general aim of the book has been to set out a full course of assaying or analysis in full detail. The work is an excellent one, and is certain of a considerable sale.

MODERN PRACTICE IN MINING. Volume II. The Sinking of Shafts. By R. A. S. Radmayne. New York and London: Longmans, Green & Co., 1909. 8vo.; 275 pp. Price, $2.25 net.

The sinking of shafts for the purpose of opening out and developing mineral wealth constitutes one of the most important branches of mining; and although a vast amount of information respecting such operations is disseminated throughout the proceedings of the various mining institutions, and excellent chapters are devoted to the subject in many textbooks on mining, so far as the present writer knows, shaft sinking has not hitherto been treated from the British standpoint of the work. While the practice described is British practice, it cannot help but be of interest to the mining engineers in this country. The illustrations are numerous and are well executed on a good scale.

AREIKA. By D. Randall Maciver and C. Leonard Woolley. With a chapter on Meroitic Inscriptions by F. Ll. Griffith. Oxford: The University Press, 1909. 4to.; 56 pp.; 42 plates.

This volume is the first of a series which will record the results of explorations in Egypt planned and financed by Mr. Eckley B. Coxe, Jr., of Philadelphia, and this is the first volume of the series to be known as the Eckley B. Coxe, Jr., Expedition to Nubia. The expedition is to be conducted for five years on behalf of the University of Pennsylvania, and the antiquities that may be obtained will be presented to the University Museum. The district selected for the researches is a part of the country which lies between the First and Second Cataracts, and this first volume records the results obtained in the year 1907. The plates are beautifully executed, and the monograph is an important contribution to the archæology of a section of the world concerning which very little is known.

THE AUTOBIOGRAPHY OF SIR HENRY MORTON STANLEY, K.C.B. By his Wife Dorothy Stanley. Cambridge, Mass., and New York: Houghton, Mifflin & Co., 1909. 8vo.; 550 pp. Price, $5 net.

Stanley was a remarkable man, and this revelation of his personal life and of his keen and unprejudiced view of men and affairs stands as one of the books of permanent importance in this field. Of all the interesting and important autobiographies that have seen the light in the last decade none perhaps has a wider appeal to all classes of readers than the autobiography of Henry Morton Stanley. The grim workhouse, the squalid life in Liverpool, the terrible experiences at sea, his adoption by a New Orleans merchant, his life as a planter, the enlistment in the Confederate army, the wonderful picture of Shiloh, his life in prison and escape, his finding of Livingstone, the exploration of the Dark Continent, the founding of the Congo State, and his closing years are described with a vigor of style which has rarely been surpassed. The book is beautifully printed and illustrated, and is certain to have a large sale, as it appeals to almost everyone.

MECHANICAL DRAWING FOR TRADE SCHOOLS. By Charles C. Leeds. New York: D. Van Nostrand Company, 1909. Oblong 4to.; 58 plates and text. Price, $2.

This work on mechanical drawing has been prepared with a purpose in view of thoroughly grounding draftsmen and others of the various machinery trades in the principles of mechanical drawing. It is also intended to familiarize them with modern drafting-room practice. The author does not believe in using models, as he thinks this tends to develop copyists, and in this he is undoubtedly correct. The author, who is connected with the Carnegie Technical Schools, finds that the results obtained by this system are excellent. The plates are on an enlarged scale, and the drawings from which they are made are well executed. There is a bill of material with nearly every plate.

IRRIGATION ENGINEERING. By Herbert M. Wilson, C.E. New York: John Wiley & Sons, 1909. 8vo.; 625 pp. Price, $4 net.

The Reclamation Service of the United States now has 21 projects which have reached such a state of completion that water is being furnished settlers for irrigation of their lands. At this date 675,514 acres are under irrigation from Reclamation projects and $42,932,787 have been expended upon the construction of works completed or in progress. The revenues collected to date from projects in operation and available under the law for reexpenditure on future construction amount to $1,079,596. The present or sixth edition has been almost entirely rewritten, bringing up to date the tremendous progress made in construction by the Reclamation Service. Since the last edition important changes have been produced in the design and in the materials used in structures on irrigation works as a result of the very general adoption of reinforced concrete for such works.

ARCHITECTURAL PERSPECTIVE. By I. P. Hicks. New York: Industrial Publication Company, 1909. Square 12mo.; 38 pp. Price, 50 cents.

BUILDING PLANS AND HOW TO DRAW THEM. By I. P. Hicks. New York: Industrial Publication Company, 1909. Square 8vo.; 73 pp. Price, 50 cents.

Legal Notices

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Grab or draft hook, D. A. Busch 938,551
Grader and drag, road, E. B. Fritchman.. 939,003
Grain cleaner and separator, F. Grotenrath 938,576
Grass catcher, H. B. McGrath 939,068
Grinder, portable and detachable disk, J. C. Ward 939,115
Grinding and polishing roll, A. Bevan... 938,547
Grinding machine, G. Larson 939,038
Grinding machine, lens, F. Buchhop..... 938,459
Grinding mill, J. Walker 938,923
Grinding solid bodies, machine for, A. J. Ericsson 938,466
Grip device, intermittent, R. D. Tittle..... 938,727
Gun, J. R. Crabtree 938,983
Gun cleaning means, R. A. Fessenden..... 938,836
Guns, device for emptying the magazines of repeating shot, T. Hardy 938,851
Hair drying apparatus, W. A. Soles..... 939,106
Hair pin, B. L. Scott 938,715
Hair waver or curler, J. R. Bux..... 938,552
Hammer and sight, combined, A. M. Powell 939,085
Harvester, beet, H. V. Lee et al..... 938,881
Harvester, cotton, C. N. Goodwin..... 938,998
Hat holder, W. R. Evans 938,998
Hatch or manhole cover, water tight, M. A. Laubeuf 938,593
Hay carrier, S. P. Lerch 938,775
Hay press, N. Piquette 938,701
Hay press sweep, N. Piquette 938,700
Hay rack, E. J. Wells 938,928
Hay rake and loader, O. J. Olson..... 939,157
Hay rake and loader, combined, O. Boyer.. 938,959
Head adjusting mechanism, C. L. Grohmann 938,479
Headlight bracket and mechanism for turning same, automobile, F. H. Aubeuf.... 938,456
Heater. See Feed water heater.
Heel sweep, reversible and adjustable, J. H. Brockman 938,963
Hinge, Larkin & Woody 938,669
Hinge for doors, spring, E. C. Scruggs..... 938,797

MAKING ALCOHOL FROM WOOD WASTE.
(*Continued from page 352.*)

gallon of alcohol, and the process costs another 6 cents, the actual cost of production being therefore about 32 cents.

The Standard Alcohol Company, owners of Messrs. Ewen and Tomlinson's patents, produces a gallon of equally pure alcohol from 5.7 cubic feet of sawdust, hitherto considered valueless, but costing, if bought for manufacturing purposes, at the outside 26 cents a ton. The cost of conversion and distillation is about 4 cents a gallon, and the total cost of materials, process, barrels, etc., does not exceed 10 cents a gallon.

The comparative cost of producing denatured alcohol is still more in the Standard Company's favor.

Wood and other vegetable fibers, as is generally known, contain a large proportion of starchy matter, which can be converted into sugar by treatment with acids. This process goes on constantly in the human body, the stomach being unable to digest starch but using its nutritive constituents when converted by the digestive juices into sugar.

The same change must be brought about in the wood waste before fermentation for the generation of alcohol is possible.

For this purpose the wood waste in the Standard Company's process is introduced into the cylindrical "digester" shown in our illustration, the door closed, and a mixture of steam and sulphurous acid introduced by an internal spray pipe while the machine is revolved. The acid acts on the starch in the wood, and at the same time the heat volatilizes the turpentine and other resinous matter in the woods used. The digester is lined with a special kind of brick to resist acid.

Upon completion of the digestion, the steam and gases are exhausted under water, which absorbs the surplus acid and liquefies the turpentine.

The treated material is then removed from the digester, and carried by conveyers to the diffusion batteries, upon the screens of which it is deposited. There it is washed by clean water, which passes through all the cells in series, becoming a stronger and stronger sugar solution. The cells are so arranged that each is filled in turn, and each in turn, when it has been washed longest, receives the fresh water, after which it is emptied of the washed residues. The liquor is next neutralized with lime, any acidity preventing fermentation, pumped into a tank and allowed to settle, the clear liquid being then pumped to the distillery fermenting tanks. A special yeast, similar to brewers' yeast, is added, and fermentation begins. From this point, the process being no different to that of making grain alcohol.

Every kind and form of wood has been used, but always with the same results, a purer alcohol being obtained than that which is generally obtained from grain. Every stage of the process has been carried on under supervision of U. S. government inspectors, and the usual licenses have been taken out.

Tests have been performed by other companies with their own staff in the Standard Company's plant, excluding everyone who has been connected with former experiments, entirely confirming the Standard Company's results, and resulting in contracts for the use of the plant under license.

The utility of this process to lumbermen will immediately be appreciated. The refuse burned will be eliminated; and if a hundred tons of wood waste a day is produced at a mill, 1,200 to 1,500 gallons of alcohol may be made from it, supplying a large quantity of power for other purposes, and still leaving the refuse with its fuel value but little diminished. The resins are extracted from pine and similar woods in the process, but the residue discharged from the diffusion battery in the alcohol process may be made into briquettes or charcoal, forming a desirable fuel salable at a good profit. Smaller mills making less than 50 tons of waste

(*Concluded on page 360.*)

Hog scraping machines, beater for, W. Gussenhoven 938,763
Horse blanket, J. W. Peirce 938,787
Horse releaser, Stires & Smith 938,721
Horseshoe, J. H. Hershberger 938,858
Horseshoe, F. von Stettina 938,907
Hose coupling, W. F. Koper 939,036
Hose coupling, I. I. Rose 939,096
Hose coupling, J. E. Ward 939,195
Hose coupling and gasket therefor, J. E. Ward 938,731
Hose coupling, train, A. H. McMasters 939,070
Hub attaching device, I. S. West 938,804
Hunting knife, G. P. Riggs 939,091
Hydrocarbon burners, feed system for, J. N. Leach 938,670
Ice cream mold gaging attachment, J. A. Aubry 938,628
Ice making apparatus, D. J. Havenstrite... 938,853
Infant's band, J. Gundel 939,012
Internal combustion engine, G. V. Benson.. 938,633
Jar tray, W. A. Lorens 938,675
Jewelry box, L. E. Brown 963,964
Journal box, G. Frowen 938,841
Journal box torsion lid, T. H. Symington.. 938,523
Key, J. Blanacych 939,184
Kiln, C. A. Matcham 939,049
Kinematograph and like instrument, E. A. Ivatts 939,135
Knitting machine latch needle, R. W. Scott 938,795
Knob, door, H. S. Lockwood 938,776
Knob spindle, swivel, J. R. Fletcher..... 939,191
Knockdown box, W. J. Neches, Jr..... 938,887
Knockdown box, W. L. Howland 939,028
Labeling machine, F. O. Woodland 938,807
Labeling machine, can, G. F. Russ..... 938,897
Ladder, J. W. Caldwell 938,638
Ladder, ironing board, and clothes rack, combined step, J. Watt 938,924
Lamp, H. F. Smith, reissue 13,033
Lamp burner, W. E. Gard 938,754
Lamp burner, incandescent, A. A. Jahnke. 939,137
Lamp holding attachment for miners' caps, O. R. Anderson 938,942
Lamp, incandescent gas, J. Maas 938,602
Lamp socket, cluster, R. B. Benjamin..... 938,632
Lamps, adjustable suspension cord for electric, T. W. Trotter 938,802
Last lock, F. J. Shainess, Sr. 938,903
Lasting machine, C. F. Pym.... 938,512 to 938,514
Lathes, feed for, C. L. Libby 939,043
Leather shredding mills, attrition plate for, G. E. Sovereign 938,798
Lifting and lowering apparatus, J. W. Vicksell 938,728
Lifting apparatus, J. H. Gilman 938,755
Lifting jack, L. Willour 938,806
Lime and apparatus therefor, burning, H. L. Doherty 938,987
Linotype and other type casting machines, matrix for, C. A. Albrecht 938,938
Liquid cooler, J. D. Hendrix 939,021
Liquid fuel burner, C. A. Bratten 939,121
Liquids, filling, storing, and discharging inflammable, Clauss & Lewisson 938,977
Litter carrier trip mechanism and reaction stop, W. Gutenkunst 938,579
Lock, H. G. Voight 938,921
Lock, H. F. Weidel 938,926
Lock, H. Eckhardt 938,991
Locomotive ash pan, R. W. Clark..... 938,824
Log conveyer, Grogan & Henson 939,011
Loom, J. Nazarian 938,886
Loom magazine, weft replenishing, H. Wymann 938,540
Loom shuttle picking mechanism, I. E. Palmer 938,785
Loom stop motion, O. A. Sawyer 963,712
Loom weft replenishing mechanism, O. A. Sawyer 938,711
Mail bag catching and delivering apparatus, T. F. Curtis 938,985
Mail pouch delivery apparatus, C. W. Broughton 938,821
Mainspring winder, G. W. Bowers 938,818
Manifolding pad, B. C. Maxwell 939,148
Marine table, A. H. Pence 938,695
Marker, self-feeding, A. G. Gunn..... 938,846
Match safe, F. Shille 939,100
Matches, combined original package and safe for, F. F. Theobald 938,913
Mechanical movement, G. W. Hart 939,193
Metal box or case, folding, F. Trieschmann.. 938,916
Metal molding, P. T. Kenny 938,708
Metal plates, apparatus for pressing parts of large dimensions from, M. A. Bourgeois 938,816
Metal working machinery, C. E. Von Norman 938,803
Metal working machines, stop for carriages of, B. M. W. Hanson 938,483
Metals, ores, etc., working, O. Frick..... 938,752
Metallic bodies, method of and apparatus for testing and sorting, J. A. Switzer.. 939,109
Metallic leaf, package roll of, W. H. Coe.. 939,189
Metallic tie and rail fastener, L. McFarland 939,087
Metallurgical process, A. G. Betts 938,634
Milk, fibrous desiccated, J. A. Just..... 939,139
Milk pasteurizer and filter, C. C. Stambaugh 939,107
Milk, utilising dried, J. A. Just 939,138
Milking appliance, Henrichsen & Hemmingsen 938,857
Milking vessel, S. W. Gerster 938,658
Mine ventilator, M. T. Melbonough 938,781
Mines, apparatus for recording bell or like signals, especially applicable to, J. Russell 938,516
Mines, priming charge for, L. Cahue 938,553
Mirror, electric mouth, B. B. Turney..... 938,525
Mixing receptacle, hand, A. Hallenberg.... 939,017
Moistener, antiseptic finger, Sauer & Potter 939,098
Molding machine, C. Mills 938,684
Molding machine, C. W. King 939,030
Molding machine, V. E. Knecht 939,032
Mop head and wringer, combined, L. J. Moody 938,695
Motion, mechanism for converting rotary into reciprocatory, J. Myrholm..... 939,063
Motor controller, electric, F. Diehl 938,649
Muffler, G. C. Hicks, Jr. 938,860
Nailer, automatic clench, P. R. Glass 938,474
Nautical instrument, C. A. McCallister.... 938,780
Navigation apparatus, W. J. Chance 938,972
Necktie fastener, W. J. Reed 938,696
Necktie holder, Ferguson & Hay 938,749
Necktie support, N. D. Nelson 938,687
Nest and brooder, combined trap, Miller & Hallenbeck 938,605
Nut lock, J. McIlwain 938,503
Nut lock, J. E. Robinson 938,515
Nut lock, C. H. Roff 938,707
Nut lock, Lawson & Wheeler 938,880
Nut lock, A. C. Woodruff 938,932
Nut lock, G. B. Martin 939,048
Nut lock, H. P. Davies 939,124
Nut making machine, F. R. & C. B. Long, 938,598, 938,599
Oil burner, W. S. Jenks 939,029
Ordnance, ammunition hoisting apparatus for heavy, Dawson & Horne 938,560
Ore jigger, means for the concentration by amalgamation of values of metallic, R. Luckenbach 938,676
Organ, reed, L. A. McCord 939,065
Outlet box, J. T. Melendy 938,882
Package tie, Lee & Gray 939,040
Packing, hydraulic, F. Hymans 938,870
Packing ring, C. R. Maples 939,047
Paints, manufacture of, R. S. Perry..... 938,505
Panel board, A. E. Blackman 938,635
Panic bolt, H. G. Voight 938,526
Pantographs, electric control for, A. T. Ziegler 938,936
Paper bag machine, O. Hesser 938,486
Paper bag making machinery, R. Duerfeld.. 938,653
Paper box for packing paints, etc., F. E. Cornell 938,981
Paper, producing translucent, H. Kuhn.... 938,877
Pasteboard with paper, etc., machine for coating, W. Kellner 938,586
Paper, producing translucent, H. Kuhn..... 938,877
Pasteboard with paper, etc., machine for coating, W. Kellner 938,586
Pasteurizing apparatus, A. A. Pindstofte... 939,162
Peeling machine, apple, R. Buchi..... 938,822
Pen, fountain, M. W. Moore..... 939,057
Penholder, W. B. Grover..... 938,709
Pencil holder, pocket, J. O. Heinley..... 938,764
Pencil point sharpener, A. W. Elsner..... 938,825
Pencil sharpener, E. H. Humphrey..... 939,133

Percolator, C. A. Stelle 938,906
Percolator, simple syrup, S. T. Hensel 939,131
Phenol halogen phthalein compound, W. B. Orndorff 939,075
Phonogram, F. C. Applegate 939,120
Phonograms, making, F. C. Applegate 939,119
Phonograph records, holder and index for, Alexander & Knickerbocker 938,800
Photometer, J. E. Cogan 938,463
Piano actions, tool for applying bridles to, A. G. Crawford 938,826
Piano pedal connection, adjustable, H. Meyer 939,053
Pick, C. H. Blow 938,805
Picker stick attachment, W. D. Park 938,694
Picture apparatus, moving, H. Voege 938,729
Picture exhibiting machine, F. H. Richards 938,895
Picture machines and stereopticons, controlling switch for moving, T. Taira 939,110
Pins, etc., machine for manufacturing grooved, A. L. Mowry 939,061
Pipe coupling, G. W. Curry 938,984
Pipe coupling, E. Marek 939,146
Pipe lines, device for passing cables through, H. A. Greeman, reissue 13,032
Pistols, etc., automatic safety appliance for, J. Tambour 939,111
Piston, T. Hall 938,481
Planing machine, W. A. Robertson 939,093
Planter, corn, V. F. Favey 939,156
Plow, F. R. Mosher 938,686
Plow, C. Christensen 938,975
Plow attachment, C. W. De Kay 938,647
Plow attachment, F. Flynn 938,839
Plow, gang, L. A. Hubert 939,132
Plow sweep, S. H. Carpenter 938,639
Plumbing joint fitting and attachment, W. J. & P. M. Forster 939,001
Popcorn popper, M. H. Hoffman 938,666
Post card, souvenir, R. Hasbrouck 938,763
Poultry hanger, L. F. Henig 938,765
Power generator, C. C. Tuch 938,918
Power tacker, portable, M. D. Phelan 938,508
Press, S. L. Carter 938,462
Press feeding mechanism, automatic, L. C. Krummel 938,876
Propeller, M. R. White 938,733
Propelling device, ship, M. Franklin 938,750
Propelling means for vessels, T. B. Taylor 938,911
Propeling mechanism, boat, B. F. Jacobs 939,028
Pruning shears, E. Arneson 938,627
Pump for automobile tires, H. Swain 938,522
Pump for wells, W. H. Larkin 938,878
Pump, steam H. L. Thompson 938,724
Punch, F. Harling 938,580
Punching holes in metal plates, machine for, C. H. Clark 939,185
Puzzle, L. W. Pullen 938,509
Puzzle, G. R. Matthews 939,050
Puzzle postal card, N. Olinger 939,074
Rack. See Advertising hat rack.
Rack, C. J. Hawkins 938,854
Radius averaging instrument, W. H. Bristol 938,962
Rail clamp, anchor, A. W. Brand 938,549
Rail clamp, guard, G. L. Hall 938,848
Rail joint, boltless, F. Kelly 938,587
Railway rail anchor, M. Swoat 938,716
Railway rail joint, A. P. Finley 938,867
Railway spike, F. B. Kobert 938,875
Railway switch, A. A. Schumacher 938,610
Railway switch, street, J. Leith 939,041
Railway switches, device to turn, Ordonez & Katz 938,889
Railway tie, L. Wylder 938,539
Railways, electric controlling and signaling system for, H. E. McDonnell 939,154
Rake, C. M. Lehigh 938,882
Raker gage and jointer, J. C. Gehrman 938,472
Reeds, rattan, etc., article made from, G. E. Pfennighausen 938,696
Reflectors, skirting for, O. A. Mygatt 939,062
Refrigerating counter, E. Carpenter 938,554
Refrigerator car, Borrowdale & Strain 938,958
Refrigerator, locker, R. L. Tilghman 938,620
Relay, self-locking, J. F. Keely 938,586
Replenishing device, J. Chandler 938,557
Rerailer, O. B. Grant 938,845
Resistance unit, H. W. Leonard 938,671
Retorts and the like, measuring feed device for, M. Rittrich 938,954
Reversing mechanism, automatic, H. O. Evans 938,997
Rivet, W. P. Bartel 938,812
Roasting separation process, H. A. Wentworth 938,732
Rock-like substance, A. D. Ney 939,072
Rolling flanged bars, H. Sack 939,168
Rolling flanged bars, universal rolls for, H. Sack 939,170
Rolling manganese steel, W. S. Potter 938,893
Rolling mill, H. Sack 939,169
Rolling mill, universal H. Sack, 939,167, 939,172, 939,173
Roofing joint, metal, L. B. Hunter 938,860
Rotary engine, R. F. Schmidt 938,714
Rod iron, M. J. Haber 938,762
Safe door cam, C. Barteis 938,545
Salve and ointment, non-odorous phenol, N. Salsberger 938,614
Sand reel, L. C. Sands 938,609
Sash fastener, C. A. Hunt 938,584
Saw attachment, J. L. Mathews 939,051
Saw handle, adjustable and detachable, R. E. Martin 938,680
Saw jointer, J. Bohyer 938,957
Scraper, hog, J. F. Lawson 938,594
Screw jack, C. V. Fowler 938,840
Screw threading implement, G. F. Chapman 938,973
Seal, W. Collins 938,979
Seal lock, W. K. Blodgett 938,813
Seals on papers, device for impressing, F. Gottschalk 938,756
Seaming machine, tinner's double, H. Poell 939,083
Section liner, E. B. Kerst 938,760
Seeder, G. A. Knoblock 938,492
Seeding device, Price & Barlow 939,087
Separator, E. H. Frickey 938,657
Sewing machine, lock stitch, F. W. Merrick 939,152
Sewing shank-eyed buttons, machine for, J. Perley 939,161
Shade roller and curtain bracket, combined, C. Wright 938,934
Shade roller bracket, window, V. T. Crawford 938,642
Shaft coupling, L. A. Westman 938,531
Shaft detaching device, M. P. Powell, Jr. 938,890
Sharpening lawn mowers, skates, etc., machine for, J. L. Kyle 938,494
Shears, A. J. Baur 938,630
Sheet feeding apparatus, A. S. Allen 939,182
Sheet feeding machine, R. R. Stickney 939,177
Sheif, hanging, J. E. Lee 938,596
Ship, H. C. Davis 938,645
Ship cleaner, H. Schwartz 938,794
Shipping cylinder cap, C. Schraudenbach 938,793
Shock absorbing pad, L. R. Nodine 938,504
Shock loader, J. R. Schuman 938,611
Shoe shank banding and cutting-in machine, Gooding & Taft 939,007
Shoe, sporting, D. J. Golden 938,843
Shoe tree, A. H. Taft 938,615
Shoes, machine for pressing and shaping the backs of, Smith & Hudsell 939,105
Shovel and hoe, combined, D. B. Hartwell 939,019
Shredding machine, Williams & Frickey 938,734
Shutter fastener or bower, G. Erwin 938,748
Sign, advertising, A. Russell 938,710
Signal transmitting and receiving apparatus, electrical, Dawson & Buckham 938,830
Sink, kitchen, W. J. Reed 938,607
Siphon, beverage, H. J. Schmitt 938,517
Skirt marker, C. C. Lumley 938,677
Sleigh, self-propelled, J. H. Hayes 939,194
Small arm, J. Tambour 939,112
Soldering machine, can, C. W. Sleeper 939,104
Soles for boots and shoes, making, O. C. Davis 938,829
Speed apparatus, variable, E. C. Marble 938,679
Speed indicator, W. Schaufelberger 938,898
Spindle. See Knob spindle.
Spring structure, H. Reidenbach 939,090
Stacker, hay, E. G. Carter 938,461
Stair guard, J. Lalonde 938,771
Stamps, automatic machine for attaching postage, H. S. Brewington 938,820
Steel ingots, treating manganese, W. S. Potter 939,892
Steel, manganese, W. S. Potter 939,084
Steel, producing finished shapes from manganese, W. S. Potter 939,164
Steel, producing finished shapes of manganese, W. S. Potter 938,891
Steel, treating manganese, W. S. Potter 939,163

(*Concluded from page 359.*)

a day may profitably combine to operate a joint distillery for the conversion of their refuse into alcohol.

Whereas it may be not a little alarming to the prohibitionists to suggest that a drinkable alcohol may be so cheaply made from sawdust, much as one may deprecate the manufacture of artificial wines and liquors and adulteration with alcohol, it is at least satisfactory that the product of the new process is actually purer than that made from grain.

TRIALS OF THE "NORTH DAKOTA."

(*Continued from page 352.*)

that of the motors being identical.

The five trials of the "North Dakota" over the mile course gave the following speeds: 22.25, 21.48, 22.13, 21.51, and 23.13, the average speed working out at 21.83 knots. She thus not only exceeded the mean speed of the "Delaware" by 0.39 knot, but the turbines exceeded the reciprocating engines by over 5000 horse-power. The maximum number of revolutions of her propellers was 286 a minute, and it was found that 263 revolutions were sufficient to maintain the contract speed of 21 knots.

In the four-hour test under full power the "North Dakota" made 21.71 knots for the first two hours, and 21.64 knots in the third hour. On the fourth mile the failure of a tube in one of the boilers necessitated the shutting down of four out of the fourteen boilers; but even under this greatly reduced power, the speed of the ship was exactly 21 knots.

A feature which, from the military standpoint, is of the greatest importance is the remarkable steadiness of the ship, even when the turbines are being pushed to the limit. Throughout the greater part of the length of the ship it was scarcely possible to tell, from any vibration, that the engines were in motion. This is a feature which is particularly appreciated by ordnance officers; since the vibration which is noticeable on ships driven by reciprocating engines is more or less disturbing to the gun sights. The "North Dakota," which is considerably the largest warship yet built for our navy, has been constructed in record time; and the Fore River Company is to be congratulated on the fact that, had it not been for delays in the furnishing of armor, they would have cut down the record for construction even more than they have. Her dimensions are: Total length, 518 feet 9 inches; beam, 85 feet 2½ inches; draft on trial, 27 feet; displacement on trial, 20,000 tons. She is the most completely armored ship afloat. Her main belt, 7 feet 6 inches wide, tapers from 10 inches at its bottom edge to 12 inches at its top edge. Above this, extending to the gun deck, is a second belt 8 feet wide, tapering from 10 inches at its bottom edge to 8 inches at the top. The 5-inch guns have a protection of 5 inches of armor, and the main turrets and barbettes are protected by 11 inches.

The lines of the ship are particularly fine, in fact, as fine as those of our armored cruisers. She will prove to be a splendid vessel when heading into a heavy sea; for not only has she freeboard, due to her forecastle deck, of 27 feet, but she is given a very pronounced outward flare, which should serve to lift her comfortably over the waves, and enable the ship to be driven at full speed in heavy weather. An innovation is the placing of the officers' quarters forward under the forecastle deck and in the superstructure immediately abaft of the two forward turrets.

The battery is mounted on the longitudinal axis of the ship, a disposition which originated with our Construction Department, and is being followed by some foreign navies. The placing of all the guns on the center line enables the whole battery to be trained on either beam, giving the ship a broadside discharge either to port or starboard of ten 12-inch guns. This arrangement, it is true, weakens the end-on fire, which, in

(*Concluded on page 361.*)

Home-Made Experimental Apparatus

In addition to the following articles, the **Scientific American Supplement** has published innumerable papers of immense practical value, of which over 17,000 are listed in a carefully prepared catalogue, which will be sent free of charge to any address. Copies of the **Scientific American Supplement** cost 10 cents each.

If there is any scientific, mechanical, or engineering subject on which special information is desired, some papers will be found in this catalogue, in which it is fully discussed by competent authority.

A few of the many valuable articles on the making of experimental apparatus at home are given in the following list:

ELECTRIC LIGHTING FOR AMATEURS. The article tells how a small and simple experimental installation can be set up at home. **Scientific American Supplement 1551.**

AN ELECTRIC CHIME AND HOW IT MAY BE CONSTRUCTED AT HOME, is described in **Scientific American Supplement 1566.**

THE CONSTRUCTION OF AN ELECTRIC THERMOSTAT is explained in **Scientific American Supplement 1566.**

HOW TO MAKE A 100-MILE WIRELESS TELEGRAPH OUTFIT is told by A. Frederick Collins in **Scientific American Supplement 1605.**

A SIMPLE TRANSFORMER FOR AMATEUR'S USE is so plainly described in **Scientific American Supplement 1572** that anyone can make it.

A ¼-H.-P. ALTERNATING CURRENT DYNAMO. Scientific American Supplement 1558.

THE CONSTRUCTION OF A SIMPLE PHOTOGRAPHIC AND MICRO-PHOTOGRAPHIC APPARATUS is simply explained in **Scientific American Supplement 1574.**

A SIMPLE CAMERA-SHUTTER MADE OUT OF A PASTEBOARD BOX, PINS, AND A RUBBER BAND is the subject of an article in **Scientific American Supplement 1578.**

HOW TO MAKE AN AEROPLANE OR GLIDING MACHINE is explained in **Scientific American Supplement 1582,** with working drawings.

EXPERIMENTS WITH A LAMP CHIMNEY. In this article it is shown how a lamp chimney may serve to indicate the pressure in the interior of a liquid; to explain the meaning of capillary elevation and depression; to serve as a hydraulic tournique, an aspirator, and intermittent siphon; to demonstrate the ascent of liquids in exhaustive tubes; to illustrate the phenomena of the bursting bladder and of the expansive force of gases. **Scientific American Supplement 1583.**

HOW A TANGENT GALVANOMETER CAN BE USED FOR MAKING ELECTRICAL MEASUREMENTS is described in **Scientific American Supplement 1584.**

THE CONSTRUCTION OF AN INDEPENDENT INTERRUPTER. Clear diagrams giving actual dimensions are published. **Scientific American Supplement 1615.**

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Inquiry No. 9034.—For manufacturers of machinery that could reduce stumps to kindling wood.

Inquiry No. 9036.—Wanted, the address of the manufacturers of "Cycle Ball Bearing Suspenders."

(*Concluded from page 360.*)

these ships, consists of only four guns, as against six guns in several foreign navies; but it is the belief of our naval officers that future engagements will be fought almost entirely broadside to broadside. Personally, we are inclined to the belief that if the third and fourth turrets were staggered, the third being moved over to starboard and the fourth turret to port, the effectiveness of the gunfire would be increased without diminishing the broadside fire.

The foremost pair of guns have a command of 33 feet. The pair immediately astern have a command of 41 feet. Turret No. 3 carries its guns about 38 feet above the sea, and those in the two after turrets have a command of about 25 feet. We shall hope in a later article to give further particulars of the trials of this vessel.

Radiations of Short Wave Length.

At the recent meeting of the British Association for the Advancement of Science, at Winnipeg, Prof. Lyman, of Harvard University, described his interesting researches on radiations of very short wave lengths. The radiations involved in ordinary laboratory work are comprised between 6,800 and 2,600 of Angstrom's scale. Schumann has demonstrated the great effect of the atmosphere in limiting the spectrum in the ultra-violet region. By the employment of lenses of fluorine, Prof. Lyman has extended Schumann's researches, especially to the region between 2,000 and 1,030 Angstrom, which exhibits peculiarities of great interest. No visible hydrogen line was found between 2,000 and 1,650. Between 1,650 and 1,030 conspicuous lines of hydrogen were observed, but they did not exhibit the grouping which is characteristic of hydrogen lines in other parts of the spectrum. No lines of nitrogen, oxygen, or helium and only a few lines of argon were detected between 2,000 and 1,030. In this region carbon dioxide and carbon monoxide show spectra of many bands. Hydrogen, argon, and helium are very transparent to these radiations, but oxygen absorbs them energetically. Here, probably, is the explanation of the opacity of air to these radiations. Prof. Lyman has corrected the limit of absorption by fluorine. This absorption begins at 1,265 Angstrom and not at 846, as had previously been believed. The chemical effects of these radiations of short wave length are very intense. Oxygen, especially at low pressures, is strongly ozonized. Gases, in general, are ionized, the more strongly as their pressure is lowered. Bumstead has shown that the photochemical action of these radiations is 25 times more intense than that of ordinary ultra-violet rays.—La Nature.

The Fortieth Birthday of the Post Card.

The first post cards were issued in Austria on October 1st, 1869. The idea had already been suggested, but not adopted, at the fifth German postal congress, in 1865. Its adoption in Austria appears to be due to an article published in 1869 by Prof. Emanuel Hermann of Vienna, who is sometimes called the inventor of the post card. In 1870 post cards were issued by the North German Postal Union, Bavaria, England, and

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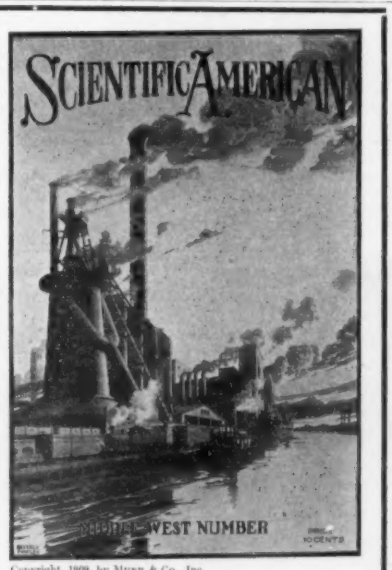
(Concluded from page 361.)

Switzerland. The German cards were printed without the impression of a stamp until 1872, in which year also the first return post cards were issued, in Germany. At the postal congress which met at Berne in 1874, and at which 22 countries were represented, the international post card of the value of 10 pfennigs, 12½ centimes, 1 penny, or 2 cents was adopted. The post card soon became popular and its use extended to other countries. Post cards are now issued in great numbers by 22 governments. In Germany alone more than 1,500 million post cards are used annually.

The private picture post card, which has attained such amazing popularity within the last decade, is nearly as old as the government post card. It is also of German invention and it owes its origin to the Franco-Prussian war. On July 16th, 1870, the first illustrated post card, bearing the picture of a gunner, was placed on sale by Schwartz, in Oldenburg. The manufacture of picture cards was afterward taken up by Brandt in Dresden. The industry, which is still carried on chiefly in Germany, has developed to gigantic proportions. Although many of the cards are striking examples of bad taste and vulgarity it cannot be denied that the best of the so-called art cards and the reproductions of famous paintings and statues have extended the love for the beautiful and that the landscape views have given to many persons some idea of the beauties of their own and foreign lands of which they would otherwise have remained in ignorance.

Expenditure of Muscular Energy in Bicycling.

Bulletin 208 of the U. S. Department of Agriculture contains a description of experiments made by Profs. Benedict and Carpenter, of Wesleyan University, on the expenditure of muscular energy in bicycling. The chief result of the experiments, which were conducted with the aid of the respiration calorimeter, is that in bicycling the muscles of the legs work with an efficiency of 20 to 22 per cent, or, in other words, for each unit of heat produced by the external work of the muscles about four units of heat are lost by radiation, in addition to the heat so lost when the body is at rest. The external work was measured by an ergometer, consisting of a bicycle, the rear wheel of which was replaced by a copper disk, which rotated between the poles of an electromagnet, forming an electromagnetic brake. By this means the work was consumed in the production of induced currents in the disk and was ultimately converted into heat, which was measured by inclosing the whole machine in the calorimeter. The rider was then inclosed, with the machine, in the calorimeter and the heat produced in a definite interval of time was again measured. This heat was made up of three parts: the heat generated in the body in consequence of its muscular activity, the heat which would be evolved in the same time by the body at rest, and the heat produced in the ergometer by the external work of the muscles. The last-named portion had been measured in the preliminary experiment already described, and the second portion was measured by inclosing the man at rest in the calorimeter. These portions having been subtracted from the total quantity of heat produced in the main experiment, the remainder represented the heat generated in the body in consequence of the activity of the muscles employed in bicycling. This remainder was found to be about four times the heat generated in the ergometer, whether the bicyclist worked moderately or strenuously and whether he was experienced or not. Training, therefore, appears to have little effect upon the thermo-dynamical efficiency. It has long been known that the human body is a highly efficient engine, but it should be noted that the high efficiency of 20 to 22 per cent, exhibited in these experiments, has been exceeded by the Diesel and some other highly developed motors.



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The Middle West Number of the SCIENTIFIC AMERICAN

On December 11th, 1909, the Scientific American will issue a number devoted entirely to the wonderful Middle West region of the United States, a number which will set forth broadly and lucidly not only the agricultural interests of that region, but also those larger engineering undertakings which are destined to transform the Middle West, in part at least, into a manufacturing territory.

With that object in view the Middle West Number will publish articles on the following subjects:

I. The Chicago and Gulf Waterway.—An illustrated description of Chicago's drainage canal, an engineering work which stands without a parallel in the world.

II. Chicago as a Railroad Center.—Chicago is the greatest railroad center in the world.

III. The Wonderful Grain Trade of Chicago.—Chicago is an enormous wheat bin, into which much of the grain raised in the middle West is poured.

IV. Shipping on the Great Lakes.—Most of the iron ore that is now smelted in Pennsylvania is mined in the middle West. To transport it to the blast furnaces of the East at a cost which will enable American steel makers to compete with foreign steel makers, it has been necessary to devise a new kind of lake transportation. Ships of 10,000 and 12,000 tons burden have been constructed which convey ore at small cost through the Great Lakes, and which are without a counterpart anywhere in the world.

V. The Handling and Shipment of Iron Ore.—The above-mentioned fact that iron ore is mined in the middle West and smelted in the East has necessitated not only the construction of special freight-carrying steamers, but also the designing of special machinery for loading and unloading the ore from the steamers.

VI. Freighting on the Mississippi.—Freighting on the Mississippi is a more important industry than most of us may realize.

VII. The Steel Industry.—One of the greatest steel plants in the world is that which has been built at Gary.

VIII. The Freight Subway System of Chicago.—Chicago can boast of a rational system of handling freight by means of subways.

IX. The Water Supply of Chicago.—Chicago's source of water is Lake Michigan. The city is supplied with water by means of a tunnel which extends two miles out into the lake.

X. Reclaiming Arid Lands.—The United States Government has under way many irrigation projects for the purpose of reclaiming lands which are arid, but which will blossom if properly watered.

XI. Harvesting the Grain of the Middle West.—Farms that cover not acres but square miles, crops that aggregate not simply bushels, but car-loads, have rendered it necessary to plant and harvest on an unprecedented scale in the middle West. The ingenious agricultural machinery which has been designed to cope with these peculiar conditions is described and illustrated.

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